TECHNOLOGY DEPT.

NATIONAL PETROLEUM NEWS

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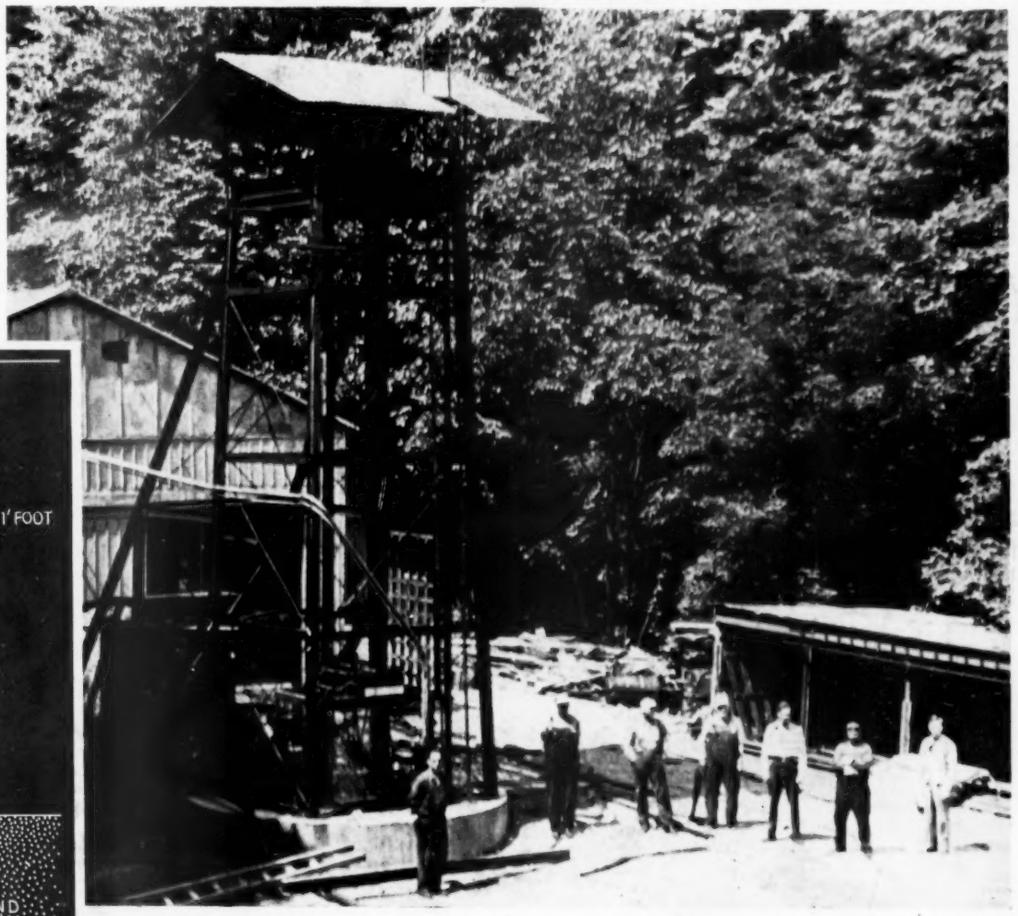
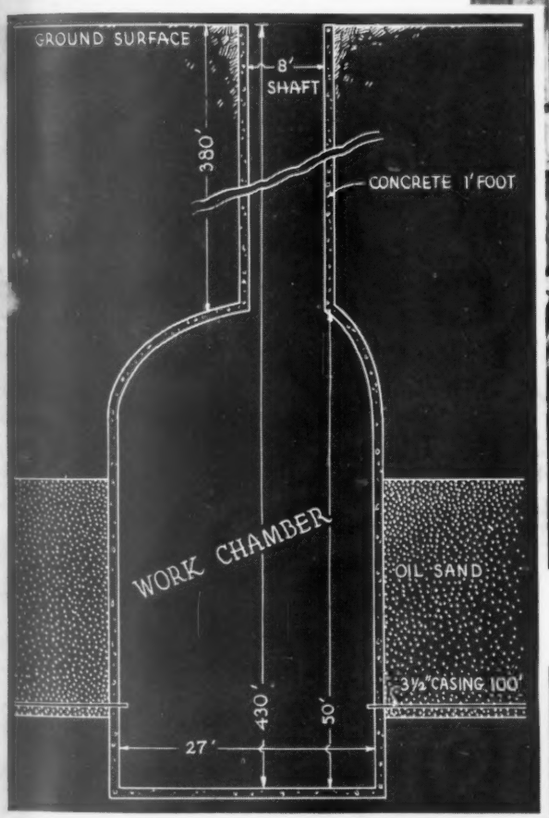
JUL 1 0 1943
DETROIT

'Wagon Wheel' Drilling Under Way in Pennsylvania

Horizontal wells, extending like the spokes of a giant wagon wheel from the bottom of a 430-ft. shaft, punch their way through Franklin First sand in Venango county, Pa., as a group of refiners and producers speed operations to drain the last drop of crude from a 400-acre tract. See story P. 35.



Venango Development Corp.'s oil "mine" 2 miles from Franklin, Pa. Over the 430-ft. shaft stands a 26-ft. derrick, and from the bottom extend horizontal wells into the oil sand



Above: Diagram illustrating the method being used to drill the horizontal well near Franklin, Pennsylvania

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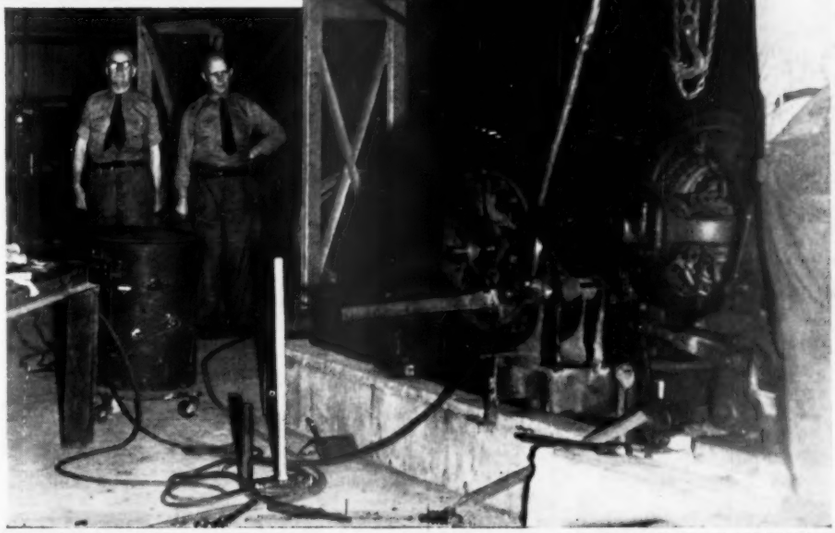
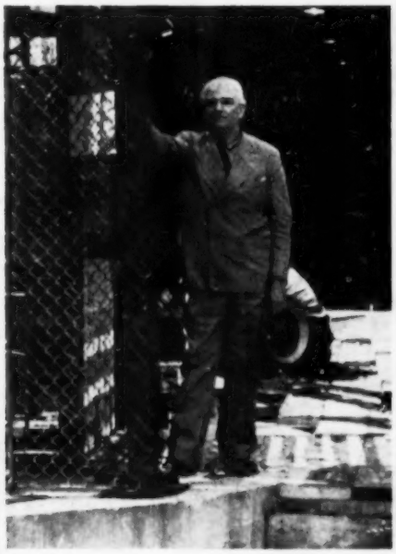
Right: View inside the work shop and machine house which stands alongside the shaft where horizontal drilling is in progress





Leo Ranney, inventor of horizontal drilling of oil and water wells, now technical adviser to Venango at its project near Franklin, Pennsylvania

REFINERY MANAGEMENT AND PETROLEUM CHEMICAL TECHNOLOGY EDITION—In 2 Sections, Section 1

AN IMPORTANT REMINDER

UNTIL 194V

Although Brodie Meters have always been ruggedly built first—to last, they embody critical materials which are obtained only with the highest priorities. Therefore, to maintain their greatest efficiency and avoid costly time and stock losses, give them the attention they deserve yet seldom require. Tag them with the reminder that "today's *FIRST* task is to make things *LAST*" until this war is won. Your best protection is regular inspection—make every gallon count.

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Facts and Flashes

From the
Technical Service Department
ETHYL CORPORATION

FOR THE WARTIME PETROLEUM REFINER AND MARKETER

1600 West Eight Mile Road
DETROIT, Michigan

Advice from parts manufacturers: When a car or truck is tied up for lack of parts, tell your parts dealer to state this fact specifically on his rush-parts order to the manufacturer. The factory will usually make immediate shipment. (Critical parts are never shipped these days to build up the stock of a parts dealer.)

Washington can't solve absenteeism problems which can be handled by the employer. One foreman has written down two rules which help him: (1) Study your worker and the cause of his absence and handle each case separately. (2) Don't lose your patience or forget you're dealing with an American who is basically patriotic.

Another pointer on warm-weather fuel economy: Carburetor accelerating pumps can be adjusted to shortest stroke and automatic choke adjusted for hot weather operation. Afterward, be sure to check fuel levels in carburetor bowls.

When constant wartime business worries weigh heavily on you, remember these words of tribute to American business by Field Marshal von Hindenburg, made after the last war: "Her (America's) brilliant, if pitiless, war industry had entered the service of patriotism and had not failed it . . . They understood war."

The petroleum industry is credited by Office of War Information with a big part in developing new lubricants, fuels, hydraulic fluids, rust preventives, etc. (in cooperation with Army Ordnance). A typical result: three standardized grades of motor oil which can be used with equal facility by gasoline and diesel motors in both hot and cold climates.

How did the Jeep get its name? Original Army specifications were for a "general purpose" car. This was shortened to "GP" to speed paper work. Slurring the two letters together in pronunciation brought an expressive new word into our language.

Today's car consciousness won't wear off. The wartime trend towards preventive maintenance for both trucks and passenger cars cannot help but affect post-war habits of owners. Service business should hold up well.

Wide-base rims give 20-50% longer tire life, according to latest truck fleet tests. Wider tire base gives fuller road contact for tread, relieves strain on sidewalls. Recommendation is to switch to rims one size wider than usually specified.

To halt delays in planting 1943 crops of Food for Freedom, eastern farmers have been given a preference rating on purchase of gasoline and fuel equal to Army and Navy ratings. Just further proof that "oil is ammunition." Let's all use it wisely.

John Harper . . . New District 1 Marketing Director

While the Petroleum Administration for War's recently-appointed District 1 marketing director might attribute to his success in the oil business the acquisition of two college degrees, chances are that he has considerable more pride in the fact that he learned about oil from the ground up.

John Harper, on leave as president of the Harper Oil Co., Long Island City, N. Y., has had many amusing experiences since June 4, 1893 —his birthdate—but one which brings a chuckle right now is his work with the conversion program.

For, shortly after returning to this country from service in World War I, Mr. Harper landed a job with the New England Oil Refining Co., working on conversion of Massachusetts mills from coal to oil. In his position as District 1's marketing director, he's again concerned with conversion—but this time from oil to coal.

But, that's a part of the "game," and Mr. Harper can take it in his stride.

Before starting work on the construction and operation of the New England Oil Refining Co.'s Fall River, Mass., refinery (now owned by Shell), Mr. Harper attended Harvard University where he obtained an A.B. and B.S. degree. In addition, he holds a Bachelor of Science degree from the Massachusetts Institute of Technology.

And just by chance—as he explains it—he later attended Great Britain's famous Cambridge University. Tuition and all expenses were footed by the U. S. Army, he explains. It happened just after World War I. Mr. Harper found himself in Germany with the U. S. Army of Occupation. In a move to foster better relations among the various countries, he was selected as one of 200 men to attend Cambridge.

"We landed at Cambridge just as the university was starting one of its annual vacations," Mr. Harper explains. "But, we didn't mind that." Mr. Harper apparently was of the view that better relations could be fostered as an "extra-curricula" activity after as well as during the regular school term. At any rate, he was at Cambridge for several months, taking whatever courses he chose.

Mr. Harper's oil industry experience includes five years with Tide Water Associated in the sales department. When he left in 1931 he was assistant department manager in the New York City office. In the same year he joined Richfield as a district manager, and later had charge of the company's terminal at New York.

Leaving Richfield in 1937, Mr. Harper started his own company, taking over all of Richfield's New York City operations. The Harper Oil Co. now operates in Manhattan, Brooklyn, Queens and the Bronx, dealing in gasoline, fuel oil and lubricants.

In his spare time—and he doesn't expect to have much of that while working for PAW—Mr. Harper may be found on his farm in Towners, N. Y., where he occasionally plays tennis.

Among objectives which he considers of prime importance in his PAW job is the need for a jobber margin increase. He plans to take an active part in "carrying the ball" as far as jobber margin increases are concerned.

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NATIONAL PETROLEUM NEWS

VOLUME 35 WEDNESDAY, JULY 7, 1943 NUMBER 27

May Widen Rail Ban To Hike Truck Use

NPN News Bureau

WASHINGTON—ODT is seriously considering a ban on all tank car hauls under 300 miles—except where special permission is granted—to encourage still greater use of tank trucks, NPN learned July 7. Up to now, a special permit has been required before tank car hauls of 200 miles or less could be made.

Action would affect all tank car hauls under 300 miles throughout the U. S., but aimed particularly at tightening up tank car use on the East Coast where there is admittedly much idle tank truck capacity.

Exceptions to ODT's Order No. 7, which bans tank car hauls under 200 miles, have usually been granted on a 30, 60 or 90-day basis. During this period, ODT advisory committees in the field survey each excepted movement to see if: (1) substitute tank trucks are available; (2) commodity is suitable to tank truck handling; (3) tank truck loading and unloading facilities are available; and (4) if the rate structure is not too much of a burden if movement is switched.

Rationing Overhaul

Maloney Committee, in Report to Senate, Urges Overhauling Rationing and Centralizing Authority Over Petroleum in PAW. Crude Price Increase Favored

WASHINGTON — Complete overhaul of gasoline and fuel oil rationing was recommended by Sen. Maloney's special oil investigating committee in its report July 3.

Committee also recommended that authority over all petroleum products, except transportation, should be centered in PAW. ODT, the committee said, "appears to be working satisfactorily and should not be disturbed."

A crude oil price increase to encourage exploration and secondary recovery in old fields was favored. The committee suggested, however, that as a compromise premiums might be paid for oil produced from newly-discovered pools in the form of a subsidy or tax.

Committee urged that PAW make a thorough study to determine how long gasoline and fuel oil rationing will be necessary, with the idea of revamping the present system to meet long-term requirements.

Although substantially improved, fuel oil rationing is not yet on a sound basis, the committee found, and charged that OPA is attempting "merely to patch up last year's formula" in revamping the system for next winter.

For improving gasoline rationing, the committee suggested a new system might be based on coupons valid for specific months.

Most serious defect in the present system, committee found, is lack of available records of total number of gasoline ration coupons outstanding at any time.

Ickes Denied Rationing Powers

Prentiss Brown Picked to Head Policy Committee; Ickes to Head Requirements Committee. Nelson Names Himself Court of Final Appeal

NPN News Bureau

WASHINGTON—PAW Ickes will continue to be responsible for maintenance of petroleum supply and its distribution down to and including the retail outlet, but his pleas to WPB for powers over oil rationing have been turned down.

Formal announcement of a new overall policy for handling oil supply and distribution problems among WPB, OPA, PAW and ODT was made by WPB Chief Nelson July 2.

The agreement sets forth clear lines of responsibility for the operations of each agency concerned, Mr. Nelson said, and provides two channels for complete review of petroleum allocation and rationing policies—the Petroleum Requirements Committee and the Petroleum Rationing Policy Committee.

Mutual understanding has been reached, Mr. Nelson said, both as to the function of each agency in the petroleum supply and rationing field and as to inter-agency relationships.

Brown Heads Policy Group

Principal changes set up by the agreement is establishment of an advisory body, the Petroleum Rationing Policy Committee, which will be made up of representatives of the 4 agencies plus the War Food Administration.

OPA Chief Brown will be chairman of the committee and will make all decisions after obtaining the advice of the committee. Dissents from his decisions may be appealed to Mr. Nelson. Rationing operations will continue to be handled by OPA. Quotas for the various rationed areas are to follow the pattern of rationed demand as shown by returned used coupons.

Available petroleum supplies of rationed petroleum products where shortages exist are to be divided by PAW Ickes after consultation with the Petroleum Requirements Committee of which Mr. Ickes will be head. This committee will be composed of representatives of the principal agencies having substantial claims on petroleum, including OPA, ODT and WPB. Dissents from these allocations may also be appealed to the WPB chairman.

ODT's Functions Outlined

In addition to ODT's transportation responsibilities and its functions of presenting to PAW estimates of petroleum requirements for all classes of transportation, that agency will determine the distribution of petroleum products among the various classes of transport, including passenger cars, within the total amount allotted for this purpose by PAW. The present arrangement by which ODT certifies to OPA the amount of gasoline to be rationed to each operator of commercial vehicles will also continue. The certifications are binding upon OPA, unless the total gallonage thus certified is in excess of the quota for this purpose.

WPB will determine the relative essentiality and priority of the various competing industrial and civilian uses for all petroleum products, including gasoline. OPA is to notify WPB if it believes any such determinations to be impractical from an operating or administrative standpoint.

The new set up, Mr. Nelson believes, will result in efficient utilization of available petroleum supplies and "provide a constant fluidity of operation to meet changing conditions."

Eastman Protests Quota Of 'Gas' Allotted To East Coast Area

NPN News Bureau

WASHINGTON—ODT director Eastman has protested to WPB Chairman Nelson that the amount of gasoline allocated by PAW for East Coast civilian use during July, August and September is insufficient and that disruption of essential services can be avoided only by increasing the allocation by at least 30,000 b/d, NPN learned July 7.

According to a recent report to the Senate small business committee, Mr. Eastman estimated the East Coast's requirements of automotive type motor fuel for the 3rd quarter of 1943 as follows: (bbls. per day).

Class of Use	PAW District No. 1	Critical Shortage Area	Per cent Total Requirements
Passenger Cars	173,045	138,436	50
Commercial Vehicles:			
Trucks	135,404	108,323	39
Intercity Buses	6,376	5,101	2
School Buses	3,111	2,489	1
Transit, including Local & Suburban Buses	17,972	14,378	5
Taxicab, Livery Cars, Ambulances, Funeral Cars & Drive-Urself	11,088	8,872	3
Total Daily Requirements	**346,996**	**277,599**	**100**

It is Mr. Eastman's belief that degree of curtailment required in commercial vehicle services in order to keep within limits of allocated supply can be sustained only by a substantial withdrawal of service now being performed by truck transport.

Cites 3 Results

Such a withdrawal, Mr. Eastman said, would produce one of 3 results, or some combination of the 3: (1) shifting of highway traffic to the rails with consequent terminal congestion and overburdening of short-haul operations; (2) tendency to isolate communities and individuals primarily dependent on truck service; (3) use of private automobiles as a substitute for retail delivery service, thereby

increasing pressure on local rationing boards for issuance of supplementary ration books.

Mr. Eastman's protest to Mr. Nelson was taken, it is understood, under protocol set up by Mr. Nelson July 2 when he announced agreement on an overall policy for handling of petroleum supply and distribution problems among WPB, OPA, PAW and ODT. (*See p. 3*).

Under this new setup, ODT is claimant agency for gasoline requirements of all motor vehicles, including passenger cars. If ODT believes requirements are greater than PAW's allocated supply, then ODT has choice of cutting gasoline use of trucks, passenger cars, etc., or protesting to Mr. Nelson that more supplies should be made available.

Southeast Governors Agree to Probe Gasoline Rationing

Special to NPN

CHARLOTTE, N. C.—Governors of the Carolinas and Georgia and the executive secretary of Florida have reached an agreement with Coleman W. Roberts of Charlotte, president of the Carolina Motor Club, to attempt to secure an "impartial investigation" of the muddled gasoline situation in the 4 states.

In this proposal to the governors of the 4 Southeastern states—only ones on the Atlantic seaboard not included in the latest ban on pleasure driving—Roberts claimed that "certain adjustments can be made that would greatly relieve the present gasoline shortage".

It was his contention that gasoline allotments in the 4 states could be increased substantially, and he proposed the impartial investigation to determine advisability of such an increase.

Govs. Broughton of North Carolina, Johnston of South Carolina, and Arnall of Georgia lent prompt endorsement to the suggestion; Gov. Holland of Florida was out of the state and in his absence his executive secretary formally approved the suggestion.

The motor club president requested the 4 governors to ask jointly for an official investigation and to appoint some state official to serve on a committee to study the situation and prepare additional data for presentation to appropriate government officials.

Pennsylvania Now Honors U. S. Certificate

Special to NPN

HARRISBURG, Pa.—U. S. government exemption certificates, Form 1094 revised, issued by the Federal Deposit Insurance Corp. and its agents and employes to cover liquid fuels purchased solely for official use, are now acceptable to the Pennsylvania Bureau of Liquid Fuel Tax.

Bulletin, No. 86, issued by the bureau on June 29, advises Pennsylvania registered distributors that the agreement to honor such certificates is effective immediately.

Seaside Oil Wins Another 'T'

NPN News Bureau

LOS ANGELES—The Los Angeles district office of Seaside Oil Co., Santa Barbara, Calif., has received the Treasury Department "T" flag denoting 100% participation in war bond purchases.

DEATHS

W. C. Moore

W. C. Moore, 85, retired oil man, died in a Houston hospital July 1.

Mr. Moore was a pioneer in the Texas oil industry and had been active in developing the petroleum resources of the state since the early days of Spindletop.

At the time of his death he was president of the Hardy Oil Co., Latex Oil Co., and La-Jarza Oil Co.

Gustav J. Steigerwald

Gustav J. Steigerwald, Cleveland, president of the Steigerwald Petroleum Co. and the Climax Refining Co., died June 29 at the age of 66 after a four months' illness.

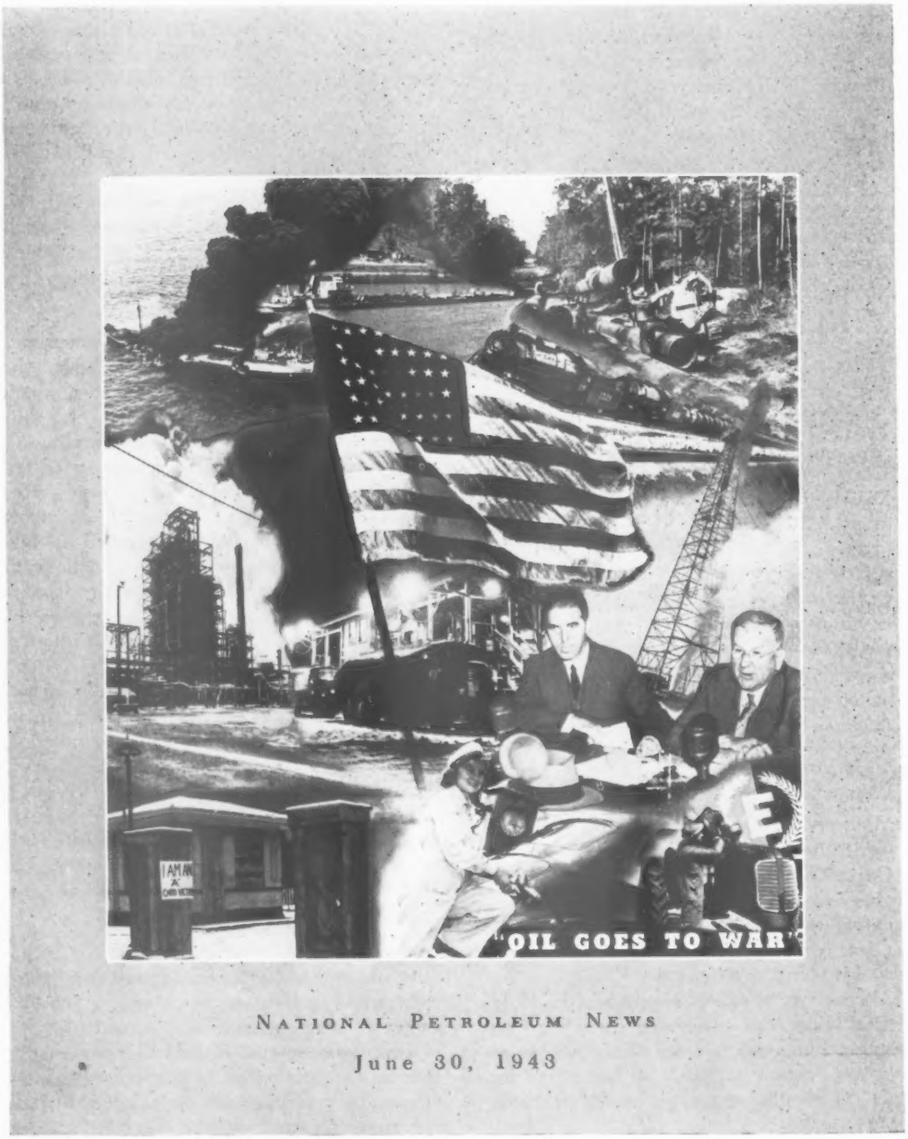
Mr. Steigerwald had been in the oil business 45 years, having started as a bookkeeper for Scofield, Shurmer & Teagle. After the absorption of that firm by Republic Oil Co. he joined the Fred G. Clark Oil Co. as a salesman, eventually becoming sales manager and vice-president.

Socony Trade Mark Decision Upheld by Circuit Court

NPN News Bureau

CLEVELAND—U.S. Circuit Court of Appeals for the 6th Circuit has upheld the decision of the U. S. District Court at Cleveland in favor of Socony-Vacuum Oil Co., Inc., in its suit against Oil City Refiners, Inc., over use of a flying red horse trademark.

For Oil Men Only!



NPN's June 30th "Oil Goes to War" cover has been reprinted in two colors on heavy coated stock and arrangements have been made to furnish this colorful picturization of the oil industry's part in the war effort to oil men for their office walls. The picture (see illustration above) is suitable for framing or it can be posted without a frame. A wide white border provides an appropriate background for this striking montage of Oil at War. The price is 50c each to cover cost of printing and mailing. Remittance should accompany your order. Please order now. The supply is limited.

NPN Reports

War Oil News and War Orders from

WASHINGTON

For ALL branches of the Oil Industry

WASHINGTON BUREAU, 1034-36-38 National Press Bldg. • Telephone National 3477 • A. M. PETTY, News Editor and Chief of Staff

Map World-Wide Supply Plan

PAW Studies Equal Oil Rations Everywhere as Part of World-Wide Programming to Meet Deficit in U. S. Supplies of Crude Petroleum

NPN Staff Special

WASHINGTON—Ironing out variations in gasoline and fuel oil rationing—so that everyone gets the same amount, whether in Maine or Oregon or refining areas of Texas or California—is just part of PAW's plans for programming world-wide supplies and demands for oil. But it is the part likely to be most troublesome.

Swiftly the picture is changing from gasoline rationing for rubber conservation and fuel oil rationing because of transportation shortage. Instead, restricted consumption is becoming necessary because of supply shortage. Crude oil supply is the limiting factor.

Transportation Catches Up

Expanding transportation facilities to the East Coast are rapidly catching up with available supplies. In times past, Mr. Ickes has repeatedly said PAW could supply more to the East if transportation were provided. Now, ODT will soon be providing more transportation than PAW can fill without disrupting supplies to other areas. Easterners might get their rations restored to original levels but it would mean deep ration cuts for other areas. Instead, PAW aims to level out supplies so that everyone in every area will share in all supplies available for civilian use. It would be possible perhaps to exempt areas around refineries but that would open the door to many headaches now bothering PAW, such as an embarrassing "surplus" in Florida.

Allen Gives Tip-off

Just what the American oil industry is up against was disclosed in figures made public June 26 by Assistant Deputy PAW Allen at Pittsburgh. He said U. S. oil requirements for the 3rd quarter of this year would total 4,750,000 b/d with supplies at 4,360,000 b/d. Obviously, that increase is due to the military program which Lieut. Gen. Sommervell told NPN recently would run a million barrels daily (not counting aviation requirements) for the rest of 1943 and would increase in 1944.

PAW contemplates setting up a new programming division with Stewart P. Coleman, New Jersey Standard's ace statistician, as director. But it is still undecided just how much the Army is willing to let PAW participate in programming military requirements outside the U. S.

If that 400,000-bbl. deficit in supply must come from U. S. sources it means a drastic cut in civilian supply. However, Mr. Allen indicated that it might come, in part at least, from South America and the Middle East. Testimony of Gen. Sommervell June 24 before a congressional committee tends to confirm this. The general said, in part:

"California is the weakest oil production spot in the United States, and must be supplemented by oil from some other area. Obviously, the nearest fields which can supplement this production are located in Colombia and Venezuela. Production in excess of refining facilities in Colombia and Venezuela is available, and this production can be maintained over a period of at least 2 years, with a small expenditure of steel. Pipeline and port facilities are available in both countries; therefore, additional refining facilities can be constructed with a minimum expenditure of steel. This added production would supplement the declining California output, and is readily available through the Panama Canal to the South and Central Pacific areas.

"Large quantities of crude oil are available in the Iran-Iraq-Kuwait-Saudi Arabia areas. Production from these fields, over and above present refining facilities, is available and justifies an increase of at least 200,000 bbls. in refining facilities in the general Persian Gulf-Mediterranean area. It would require a comparatively small amount of additional drilling to maintain this production on account of the enormous sand thicknesses and large production of the individual wells. Preliminary investigation indicates that additional refining facilities in the Persian Gulf-Mediterranean area can be made without undue expenditures of steel and equipment, and that the additional petroleum products will be available to the Mediterranean area, as well as to areas east of the Persian Gulf."

May Tie Into New RFC Plan

Relief has been expressed that RFC's new Petroleum Reserves Corp. ties in in some way with the Army's foreign oil plans. The new RFC unit was chartered to acquire oil reserves outside the U. S., produce, store, transport, process and sell such oil. Also, the new government-owned corporation is authorized to construct and operate, outside the U. S., refineries, pipelines, storage tanks and other necessary facilities.

Domestic Resources Burdened

Drawing on outside sources would ease the additional strain that otherwise would have to be placed on domestic sources. Even so, the strain is severe.

Farmers in Kansas, Iowa and Nebraska are complaining that they can't get enough gasoline and tractor fuel. War Food Administration has instructed county war boards to get the facts and forward to PAW's district marketing director at Chicago.

Many refineries in the Mid-West have been unable to get enough crude to fill their allocations from PAW. Some small refiners regard PAW allocations as "only a hunting license".

Cooperative refineries are complaining that they have been "short-changed" in the allocations, not getting their share of crude supplies available. They took their complaints to PAW, then "appealed" to Capitol Hill.

Automotive gasoline stocks in the Mid-West are on the toboggan. At the end of June, District 2 stocks were approximately 24,000,000 bbls. Decline was as follows: March, 29,000,000 bbls.; April, 27,000,000 bbls.; and May, 26,000,000 bbls.

Gasoline stocks east of the Mississippi in District 2 have been hit even harder: April 16, 15,320,000 bbls.; May 7, 15,200,000 bbls.; and June 19, 12,313,000 bbls.

District 2 Crude Stocks Melt

Crude oil stocks located within District 2 have dropped 25,000,000 bbls. or 28% since January, 1941, as follows: January, 1941, 93,000,000 bbls.; June, 1941, 87,000,000 bbls.; June, 1942, 76,000,000 bbls.; and mid-June, 1943, 68,000,000 bbls.

Despite this decline, some mid-western oil men urge still greater drafts on District 2 crude stocks, contending that the emergency they were being held for is now at hand. Heavier withdrawals from storage now would tide refiners over until a pipeline is built to tap West Texas for District 2 refineries.

Production Falls Off

District 2 refiners probably could use another 200,000 b/d of crude. But there is little hope of getting it from local production, according to sources here. Kansas and Michigan may be able to hold to present production levels (around 300,000 and 60,000 respectively) due to increased exploratory efforts. However, Illinois is shot, with prospects that it will drop very fast in next 6 months.

From a 1939 high of 500,000 b/d Illinois has dropped to about 215,000 b/d now and may be nearer 100,000 b/d before the year ends. Oklahoma is slipping, barely topping Kansas now.

Rural Road Travel in East Over 50% Below Pre-War

WASHINGTON—Rural road traffic in the East has dropped to less than half of pre-war normal during the 6 months from December through May, Public Roads Administration reported July 6 in announcing May records of 519 automatic traffic counters in 40 states.

Washington Outlook . . .

Manpower Problems Hurt Refining, Production

By A. M. PETTY, NPN News Editor

Manpower resources are being depleted alarmingly in production and refining just when skilled labor requirements are increasing with the stepped-up drilling program and new 100-octane plants going on stream.

Prompt action is needed to head off oil workers drifting away from the industry, to bring back skilled men from other industries and to win new recruits.

Situation calls for an intensified program—nationally and locally—to reiterate oil's vital part in the war program. Local draft boards need education on this so that they may recognize the validity of deferment claims for skilled workers. That really means educating the public generally, because draft boards are a cross-section of the population.

Oil workers must be made more aware of the importance of their jobs in finding and producing oil, in making it into warplane fuel, TNT, synthetic rubber and other war products. They must feel that they are contributing more in their present jobs than in a shipyard, an ordnance plant or even in the armed forces.

More statements by high-ranking Army and Navy officers will be helpful. Lieut. Gen. Somervell's disclosure that the U.S. military program needs a million barrels of products daily—not counting aviation requirements—points to the enormity of military demands on the oil industry.

There should be more discussion of the industry's postwar prospects. Workers may get the idea that 100-octane plants are only temporary, like ammunition factories, which will shut down when the war ends. This fear is groundless. Automotive engines, as well as greatly-expanded aviation, will be running on 100-octane. The refining branch's prospects as a manufacturing industry—plastics, synthetic rubber, etc.—should be pointed out.

A war plant job in the oil industry is a permanent peacetime job. That should be emphasized.

Nor should workers be worried by the talk of oil shortage. There is no immediate shortage, but replacement oil must be found to replenish reserves. And that will be done with more equipment available and a better price allowed. More drilling means more jobs in production.

Primarily, this is an educational program. It should be undertaken at once, by the industry generally and oil companies individually. Delay may mar the industry's already splendid record in the war effort.

° ° °

PAW's program for gas enrichment with low-grade gasoline instead of fuel oil, is now safely interred beyond hope of resurrection.

E. E. Overton, who headed up the work, has been transferred to PAW's New York office. His technical assistant, Richard Brannan, has left PAW to help on a large chemical project.

Program was to substitute 16,200,000 bbls. of low-grade gasoline for the 18,000,000 bbls. of fuel oil used annually by the manufactured gas industry. This would release 12,100,000 bbls. of residual fuel oil in District 1 where it is so badly needed. Besides this, many tank cars would have been saved because 10% less volume would have been required.

PAW's brass hats killed the program after pressure from the gas industry which contended that gasoline was too much of a fire hazard. (This was denied by PAW men working on the program, who pointed out that some gas plants had changed over to gasoline already.)

° ° °

Oil company lawyers have put PAW's Directive 68 under the spectroscope.

Is it really a "green light" for joint use of bulk plants?

Will the "trust busters" become color blind in postwar prosecutions?

These questions are bothering some lawyers who warmed the benches of Judge Stone's courtroom at Madison 5 years ago.

Meanwhile, the lawyers' caution has held up PAW's program for getting oil distribution facilities declared essential on a "locally needed" basis. One of the steps in that direction was compliance of all marketers in an area with Directive 68.

° ° °

PAW's oil-to-coal conversion program is being quietly reappraised in light of coal production decline due to strikes.

Coal rationing "is a possibility—undoubtedly," says Mr. Ickes in his capacity as Solid Fuels Administrator after conferring with himself in his new role of Federal Coal Mines Administrator. But he is reluctant, as Petroleum Administrator, to discuss the possibility that PAW may have to pull in its horns further on its conversion program.

John L. Lewis' strike cost coal production 23,000,000 tons during May and June. If that cannot be made up (Mr. Ickes thinks it can be), then the first "customers" that should be cut off are those that the coal industry has not now—the industrial fuel oil installations which haven't yet converted to coal.

° ° °

Penn Grade crude oil prices are getting some attention from OPA. Three OPA accountants will leave Washington July 8 for a swing through oil regions of West Virginia, Pennsylvania, Ohio and New York. In all, they will visit about 100 producers during the next three weeks, gathering production cost data. OPAers admit that production costs are up, but they want to find out how much.

PAW wanted OPA to take time for a larger sampling of producers. OPA's reply, in effect, was: "What do you think we're doing—a Tariff Commission survey?"

OPA wants to clean up the Penn Grade cost study within a month after the figures are in. (Tariff Commission's crude cost survey took more than a year.)

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Just in case a deeper dent is made in supplies to the Pacific Northwest, PAW is assembling data on overland transportation of products from Districts 4 and 5 to Oregon and Washington. Supply sources are also being studied. When all the facts are ready, PAW may go to RFC for a plan to compensate for extra transportation costs, just as now operates in the East.

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Worst "gas" rationing headache for OPA and PAW is in the Columbus, Ga., area. Across the river lies Phenix City, Ala., in District 3 where "A", "B" and "C" coupons are worth 4 gal. each, while in Columbus an "A" coupon gets only 1.5 gal. and "B" and "C" coupons, 3 gal.

It is little wonder that 25,000-gal. stations in Columbus have dropped to a 100 gal. a month while overall gallonage of stations at other end of the bridge has jumped 500%. Curb pumps in the Alabama town are up from 1500 to 15,000 and more.

Easiest solution would be to bring Phenix City into the shortage area. But the howls would be heard as far as Capitol Hill in Washington.

To take Columbus out of the shortage area would simply start a gold-rush on its stations, drying up other outlets in nearby Georgia area.

Of course, if OPA and PAW heeded the advice of OPA Regional Rationing Chief Sommers and took Florida and Georgia out of the shortage area, that would fix everybody up in fine style—except Carolinians to the north.

Higher Priorities Granted To 100-Octane Projects

WASHINGTON — PAW officials were "greatly pleased" July 7 at WPB's upgrading of 100-octane projects from AA-2X to AA-1 in priority ratings. This has effect of pulling aviation gasoline plants into the same category as other military "musts" such as aircraft and escort vessels, it was said.

Still in the AA-2X class, however, are 100-octane projects for completion in 1944.

Norris City Sets Record

WASHINGTON—Oil shipments from the Norris City, Ill., terminal of the "big inch" pipeline to the East Coast set a new record for a single day on July 3, totaling 337,000 bbls.

Navy Cancels Elk Hills Contract

Statement to House Committee Reveals Navy Doesn't Agree with D. J. Opinion That Contract is 'Illegal'. Attempt to Hush Hearing Fails

WASHINGTON — The Navy today sent House public lands committee its answer to charges by Assistant Attorney General Littell and Controller General Warren that the Navy-California Standard Elk Hills contract is illegal and invalid and against the public interest.

A forwarding statement by Adlae E. Stevenson, special assistant to Secretary of the Navy, said the Navy did not "propose to engage in any dispute with the Department of Justice regarding the law. Without agreeing, we deem its opinion controlling and the Secretary of the Navy has already acted thereon to rescind the agreement."

The Navy said it could not permit the charges to go unanswered indefinitely. Doubts have been raised, the Navy said, "not only in the public lands committee, but elsewhere as to the competence of the Navy's stewardship of its petroleum reserves." The Navy charged that Littell's criticism of the contract was "unwarranted and misleading." During the congressional recess, the Navy said, it would canvass other means of solving the Elk Hills problem permanently and consult with Justice Department and Interior Department.

To Propose Alternates

Alternate plans of obtaining government possession of Elk Hills will be laid before the committee after the recess.

Standard's plan of drilling during the initial 5-year period, Navy disclosed, will possibly produce 62,500,000 bbls. of oil from its own lands. Navy pointed out this is more than double the amount Standard is permitted to produce during that period for all the lands within the reserve under the contract.

Of this amount, Navy estimated, Standard will drain 12,000,000 to 15,000,000 bbls. from Navy's land in the 5-year period.

The Navy presented estimates of Standard's reserves in the shallow zone totaling 106,000,000 bbls. and in the deeper Stevens zone about 198,000,000 bbls. Estimates placed Navy's reserve in the shallow zone at 226,000,000 bbls., giving a total for the shallow zone owned by both Standard and Navy at 332,000,000 bbls.

The Navy statement said that the conclusion is "inescapable" that Standard, through the contract, is "giving up millions of dollars of profit that it would otherwise make in the operation of its own properties."

The House public lands committee began delving into the Navy's side of its Elk Hills contract with California Standard on July 2, with subsequent hearings July 3 and 6.

Ralph W. Richards, geological survey scientist on loan to the Navy petroleum reserve, defended the Elk Hills contract as "fair to both parties (Navy and California Standard) and very much in the public interest."

Committeemen pressed him for his reasons for considering the contract a good one for the Navy. His explanations were hotly challenged by members, particularly Rep. White, Idaho, and Rep. Peterson, Ga.

Mr. Richards gave his testimony flanked by W. Keith Kane, attorney in Navy Secretary Knox's office, and Rear Admiral Stuart, director of naval petroleum reserves.

Under sharp questioning, Mr. Richards reluctantly gave the committee his estimate of the value of Standard's holdings in the reserve. Wide differences between his figures and those of Standard as to the value of its various sections were disclosed. Standard's estimated net present worth was $145,373,862 and the government geologist's estimate was $20,279,070, Mr. Richards revealed.

The geologist explained, however, that his estimates were not complete for the value of oil, gas and gasoline in the Stevens formation, the deep zone, and told the committee they should not be taken "seriously" and were used only for "trading purposes" in negotiating with Standard.

Pressed by Rep. Murdock, Ariz., for further explanation of his estimates, Mr. Richards asked to be excused from answering on the basis of "public policy".

Sought to Bottle Up Hearing

Navy Attorney Kane sought at the hearing July 6 to have the committee hear Mr. Richards' further testimony behind closed doors. The committee refused, Rep. White asking if he did not recognize "the interest of the American people in this contract".

Mr. Kane then sought permission to question the witness in order to "clarify" some of his statements previously made to the committee. This request was also denied and he was told that witnesses in testifying were "on their own".

Attorney Kane took exception to several exhibits filed with the committee by Assistant Attorney General Littell, who declared the contract "illegal and invalid". Mr. Kane said the exhibits revealed "complete misunderstanding" of the data and that Navy "accepts no responsibility for the data or for the effect of its publication".

He requested that the committee ask Mr. Littell if he read the engineer's report on Elk Hills before he made his report on the contract. At the instance of Rep. White, Chairman Peterson ruled that Mr. Kane submit his request in the form of a memo to the committee.

Objects to Condemnation

Mr. Richards objected to condemnation to obtain full government control over the reserve as it might mean the government would have to pay $216,000,000 or "even more". Quizzed as to the basis of Navy Secretary Knox's minimum estimate, given the committee June 25, of 27,000,000 bbls. as the amount of Standard's reserves, Mr. Richards said this "may reflect my 1940 estimate of the sand's (shallow zone) thickness."

Rep. Barrett, Wyo., charged that Standard was trading off depleted sands for Navy's undepleted area in the reserve.

Rep. Peterson, Ga., presented figures which he asserted showed that the repayment provisions in the contract make it possible for Standard to get more than 17% of Navy's oil. He demanded to know if Mr. Richards thought this was in the public interest.

The geologist replied he wanted time "to consider before making an answer" to the figures set up by the Georgia member.

Who actually wrote the contract was revealed after persistent questioning. Attorney Kane, who explained that he had only been connected with the case little more than a month, identified him as "a man named Beutner" in the judge advocate general's office, a civilian employe.

Mid-West Restrictions On Yields Removed; July Allocation Set

WASHINGTON—PAW has removed all restrictions on gasoline yields of District 2 refiners. This is a temporary step to provide more gasoline for farmers, PAW explained. How much more gasoline will be made in July depends on refinery operations. Some plants didn't push their yields up to 85% of last 6 months of 1941 yield when given "green light" to do so.

District 2 crude allocations for July total 1,125,000 b/d compared with 1,165,000 b/d for June. Actual runs in June, however, were around 1,100,000 b/d due to some refiners' inability to get crude. PAW believes there is 1,125,000 b/d available, if distributed properly.

In District 3, July crude allocation is 1,410,000 b/d, up 63,000 b/d from the June figure. Gasoline yield restrictions have been lifted from Gulf Coast non-war plants; 70% was former basis. Inland Texas plants will continue on June basis until new quotas are worked out.

District 1 refinery crude run quotas have been increased 10,000 b/d over June quotas to 660,000 b/d. Of the total, about 106,000 bbls. will be assigned to plants in the Appalachian area.

Franklin Goes to Washington

WASHINGTON — PAW Ickes announced July 7 that Wirt Franklin, District 2 production director and director in charge, has accepted the post of special field assistant attached to the office of Deputy PAW Davies. No successor to Mr. Franklin in the District 2 office was announced.

On Capitol Hill . . .

May Take Crude Price Question to President

By WILLIAM J. MADDOX, NPN Staff Writer

WASHINGTON—Rep. Hartley's East Coast gasoline rationing bloc has seized the crude-price-hike ball and hopes to carry it right to the White House. If the New Jersey republican doesn't succeed in hurdling all the obstacles for getting a hearing for his group with the President, it won't be because he didn't make a good try.

There have been other attempts to lay a crude-price plea before the President, but the nearest they have gotten thus far has been War Mobilizer Byrnes and Economic Stabilizer Vinson.

Hartley says he's fed up with intimations that something will be done for crude prices if boosters in Congress will hold off pressure "for a while longer".

Other members, more directly concerned with crude than Hartley and who have been working longer for a price boost, share his feeling that they have been lulled by whispers of early action. They are sore at themselves for not having formed a bloc and made a concerted drive for an increase.

Now Congress is getting ready to go home for 2 months, and the crude-price-hike bills are still in committee with no prospect of being reported out until after business is resumed Sept. 15.

Hartley is going to ask the President himself for an interview with his group. He says he's through waiting for Byrnes to make an appointment.

The plea will be for an average increase of 35c a bbl. backing up PAW Ickes' recommendation, which OPA Chief Brown turned down.

Some members of the bloc favored an increase of 50c, but the lower figure was agreed on.

They believe that a hike in crude prices would mean more gasoline and fuel oil for the East Coast, basing their belief on testimony presented at their hearings last month.

The bloc is also going to urge on the President the need for a more efficient gasoline rationing system that will prevent black markets and coupon thefts. They also want the pleasure driving ban extended immediately to the Mid-West, on the theory that the ban is coming eventually and why not now.

* * *

Fresh backing for higher crude prices has come from the House naval affairs oil subcommittee, headed by Rep. Rivers, S.C. The group returned to Washington July 1 from field hearings in Illinois, Arkansas, Mississippi, Texas and Louisiana.

Testimony gathered convinced the group that a price boost is needed, and this will be stressed in the forthcoming report.

The committee ran into a general demand for higher prices. Most requests were for an average increase of 35c a bbl., but in some places 50c and even higher was urged.

Producers generally were found to be having trouble in obtaining manpower and materials needed to carry on operations. Complaints were registered also against drilling restrictions and lack of transportation.

The committee believes there is an adequate supply of crude to warrant building the Tinsley pipeline. In addition to production of the Tinsley field, feeder lines could pick up from 30,000 to 40,000 b/d in Louisiana and added supplies could be brought in by building feeder lines into Texas, the committee thinks.

Although production in Mississippi is declining, data collected by the group indicate there is much more oil there that could be brought into production.

Uppermost problem found in Texas, in addition to price, was transportation.

The committee brought back recommendations for 3 new pipelines to pipe out West Texas oil—1 to the West Coast, 1 to Chicago, and 1 to the East Coast.

* * *

Rep. Lea's oil investigating subcommittee (the old Cole group) added its plea for higher crude prices in a report to the House July 3 (*see page* 24).

The committee's recommendation that government agencies join in developing foreign oil fields, especially those on the Persian Gulf, gives an added fillip to intimations from other sources that the government is getting ready to move in this direction.

Back in May Rep. Jed Johnson, Okla., wrote Secretary of State Hull asking if newspaper reports that Mexico was negotiating for priorities on $50,000,000 worth of oil equipment were true. Hull's reply hewed close to the line:

"In reply to your inquiry as to whether this newspaper story is correct, I advise you emphatically that it is incorrect. The government has been carrying on discussions with the Mexican government with regard to a certain petroleum industrial operation considered vital to the war effort. The discussions do not involve a general plan for development of the Mexican petroleum resources. The plan under discussion if consummated will not involve either drilling equipment or oil pipe, so that there is absolutely no ground for criticism on the part of those who are having difficulty in securing material to carry on petroleum drilling in the United States.

"As a matter of policy, I am not supporting application for priority materials for the petroleum industry in other countries except when the provision of these materials is obviously in the interest of this country in connection with its prosecution of the war."

* * *

Another pledge against postwar activities by PAW is on the record. Deputy PAW Davies recently assured a group of senators, headed by La Follette, investigating East Coast gasoline shortage, that the day peace is declared PAW will start liquidating.

Everybody—meaning himself and other key executives from the industry—is anxious to get back home and on his regular job again, Davies declared.

* * *

Davies' connection with California Standard bobs up now and then in Congress, usually coupled with the assertion that in addition to his PAW pay he still receives a salary of 50-some thousand from Standard.

Asked at a press conference to comment on recent charge by Sen. Clark, Mo., that Ickes surrounded himself with "big company" men, Ickes said:

"That's a matter of regurgitation of food long in the process of digestion. Perhaps Mr. Clark had in mind Elk Hills. Please note that it was this department, not the Department of Justice, that first brought attention to the Elk Hills contract."

* * *

The Cole pipeline act has been extended for 2 years to June 30, 1945. Congress rushed the extension (H.R. 2520) through and to the President just in time to beat the expiration date.

At about the same time Congress rushed through a resolution (H. J. Res. 139) to prolong the interstate oil compact for 4 years from Sept. 1. Both measures got Presidential approval.

* * *

Three crude-price-boost bills introduced this session have yet to come to the floor. One, introduced by Sen. Thomas, Okla., is still on the table and the others are hanging fire in the House banking and currency committee—H. Res. 233 by Wright Patman, Tex., and H. R. 2887 by Wesley Disney, Okla.

Also before House banking and currency is Sen. Maloney's 885 to create a Civilian Supply Administration. The measure passed the Senate May 10, but interest in the House seems to be lacking.

All 4 measures will go over until members get back from the 2-months' recess about Sept. 15.

* * *

Treasury officials, looking forward to the general tax bill to be tackled when Congress gets back, are preparing to renew their attack on depletion allowance. They have been beaten each year in attempts to have the allowance deleted. Oil members are confident the provision will be retained. They say they have even better arguments this year.

Florida Puts Finger on PAW

Gov. Holland Claims Tax Figures Show Gasoline is Backing Up in His State and Rations Should be Hiked. PAW Finds Letter Hard to Answer

NPN Staff Special

WASHINGTON—Before renewing efforts to get their state taken out of the East Coast shortage area, the Florida congressional delegation is awaiting PAW Ickes' reply to the well-documented protest from Gov. Holland of Florida.

Mr. Ickes has had Gov. Holland's letter since mid-June. His staff is having difficulty agreeing on an answer because the governor has raised some embarrassing questions about PAW's figures on Florida gasoline stocks. Florida's inspection tax law, with refunds for exports from the state, provides detailed data on inventories. These show steadily increasing stocks for some months while PAW had contended stocks were declining.

PAW has done its best to syphon off "surplus" stocks from Florida and Georgia for movement north but inventories continue to climb. So why not allow Florida and Georgia "A" card holders a 4-gal. gasoline ration instead of 1.5 gal.? is the question asked.

Small tankers bringing supplies across the Gulf to Florida points could not be used elsewhere, according to Florida oil men. Likewise, the barges in that service are being put to best use possible.

PAW could curtail this water movement but would run the risk of being charged with "creating" a shortage. In fact, an OPA official has indicated he is ready to hurl such a charge at PAW, should events move in that direction.

OPA Man Urges Action

Harry Sommers, OPA's southeastern rationing chief at Atlanta, has strongly urged taking Florida and Georgia out of the shortage area "until such a time as a real shortage developed in gasoline, and from what I know now, I don't believe any such shortage will ever exist unless it is artificially created."

Florida delegation is also relying on a wire June 16 to PAW Ickes and OPA Chief Brown from Harold Colee, of the Florida State Chamber of Commerce, which reads in part as follows:

"Gasoline distribution in the state is no longer dependent upon the over-worked tank car pool. The trans-Florida pipeline and attendant barge systems are now bringing into the state considerable more gasoline than can be sold under current restrictions or moved north to supply the serious shortage states. Gasoline is accordingly backing up in storage in the state. Terminal inventories at the end of April, 1943, were 61% higher than average inventories during 1942, 106% higher than the low point reached in November, 1942, 68% higher than in December, 1942. Inventories will continue to climb.

"The trans-Florida line has not yet reached capacity operation yet total receipts into the state for all purposes in April were more than twice those of December, 1942. Exports from the state have jumped 7 times from December to April but cannot go much higher, in the opinion of industry and government officials, because facilities for moving gasoline north are now almost fully utilized. For example, total receipts for April were more than 10,000,000 gal. in excess of March but exports increased less than 3,000,000 gal.

"If it were possible to move any substantial part of this surplus or storage from Florida to the extreme shortage areas there would of course be no occasion to consider loosening the restrictions in Florida. However, it is not possible to do so, and we therefore insist that these restrictions be lifted."

Mr. Colee sent a copy of his telegram (quoted above) to Mr. Sommers of OPA's Atlanta office. Mr. Sommers replied as follows:

Text of Sommer's Reply

"Have copy of your telegram to Messrs. Brown and Ickes of June 16 on the subject of the gasoline supply situation in Florida.

"For months I have contended that Florida did not belong in the eastern restriction area and despite the strongest justification of this position PAW persists in refusing to acknowledge the facts as they are. At the recent meeting in Atlanta we endeavored to clarify this situation with a representative from PAW without any result other than a realization that PAW does not have an open mind on the subject. And I write to urge that you continue to press this matter upon the authorities in Washington. It simply doesn't make sense for the people in Florida to be penalized for a condition in the Northeast and not be allowed to use gasoline which is available.

"I might point out that PAW took the same position in Florida and Georgia on conversion from fuel oil to coal and when this office resisted the program as being impractical and when they could no longer sustain their position, they removed Florida and Georgia from the conversion program area.

"We here want to administer the regulations when they are fair and practical, but we don't want to be concerned with rationing just for the sake of rationing, and if this matter were left to me I would remove Florida and Georgia from the eastern restriction zone until such time as a real shortage developed in gasoline, and from what I know of the matter now, I don't believe any such shortage will ever exist unless it is artificially created."

Urge Careful Scrutiny Of Questionnaires

WASHINGTON—Business men are urged to scrutinize carefully any requests for information by government bureaus and to report to the Advisory Committee on Government Questionnaires or to the Bureau of the Budget any that do not bear a Budget Bureau approval number.

With a few exceptions, every authorized request for information must be approved by the Budget Bureau, W. J. Donald, chairman of the advisory committee, points out. Report forms that have such approval bear an approval number and in most cases an expiration date in the upper right hand corner of the form. Whenever the absence of such symbols casts doubt on the legitimacy of the questionnaire, business men are urged to make inquiry either of the Budget Bureau or of the Advisory Committee, whose offices are at 1615 H St., N. W., Washington, D. C.

Mr. Donald also said that particularly burdensome questionnaires, even if they have been authorized, may also be questioned. Business men will be heard through the advisory committee or its approximately 40 specialized subcommittees whenever a form is reconsidered at the time of its expiration.

The advisory committee, organized to reduce the burden of government reports upon business, is composed of representatives of the American Retail Federation, American Trade Assn. Executives, National Assn. of Commercial Organization Secretaries, Chamber of Commerce of the United States, Controllers' Institute of America, National Assn. of Manufacturers, and National Industrial Council.

Quota 48,000 Higher On Passenger Tires

NPN News Bureau

WASHINGTON—Apportionment of district quotas for passenger car and truck tire rationing in July, based on rationing allotments assigned for the month by the Office of Rubber Director, were announced by OPA June 30.

Total quota of Grade 1 tires—all new passenger car tires are Grade 1—for all the 104 rationing districts in the country is 1,061,261 compared with 1,012,000 for June. Grade 1 tires go principally for needed replacements on cars with a monthly mileage ration exceeding 240 miles.

Quota of Grade 3 tires—used or recapped passenger car casings—is 414,931, against 690,000 for June. This drop, OPA said, is reflected in a recently announced change in the rationing regulations restricting eligibility for tires of this kind to drivers with mileage of 240 a month or less who qualify.

WAR ORDERS *for the* OIL INDUSTRY

NPN will appreciate hearing from its readers if they feel any pertinent regulations have been omitted from this page.

Copies of the complete text of the following orders can be obtained from PLATT'S OIL-Law-GRAM, 1213 W. Third St., Cleveland, Ohio.

Minimum charge for single copies, $1, postage paid. One year's service, $75.

Code: AO—Administrative Order; CMP—Controlled Materials Plan; D—Directive; FDO—Food Distribution Order; GMPR—General Maximum Price Regulation; GO—General Order; I—Interpretation; L—Limitation Order; M—Conservation Order; MPR—Maximum Price Regulation; P—Preference Rating Order; PAO—Petroleum Administrative Order; PR—Priorities Regulation; PrR—Procedural Regulation; PS—Price Schedule; RO—Ration Order; RPS—Revised Price Schedule; SO—Supplementary Order; SR—Supplementary Regulation.

The Week's Orders

(Issued from June 26-July 3 inclusive)

PAW—Petroleum Administration for War
- PAO 11—Secondary recovery, SO 6
- PAO 13—Fuel oil deliveries

RO—Ration Orders
- 1A—Tires, Am. 35, 36
- 5C—Gasoline, Am. 56, 57, 58, 59, 60, 63
- 11—Fuel oil, Am. 67, 68, 69, Am. 6 to Supp. 1

PR—Prices
- 63—Tires, Am. 12
- 66—Tires, Am. 3
- 88—Lube oil, Am. 111
- 107—Tires, Am. 10
- 165—Services, Am. 24
- 414—Supply of tire mileage
- GMPR—Aviation gasoline, Am. 16 to SR 1
  Prices increases, Am. 8 to SR 15

L Orders
- L-307—Anti-freeze containers

ODT—Office of Defense Transportation
- GO 21—Trucks, Am. 8

BIR—Bureau of Internal Revenue
- Salary increases

RFC—Reconstruction Finance Corporation
- Petroleum Reserves Corporation

Digest of Week's War-Oil Orders

PAW—Petroleum Administration for War

FUEL OIL—PAO 13—WPB order L-56 restricting fuel oil deliveries reissued by PAW as PAO 13; new order incorporates regulations of old one; also extends restrictions to Alabama, Arizona, Arkansas, California, Colorado, Florida (west of the Apalachicola River), Idaho, Louisiana, Mississippi, Montana, Nevada, New Mexico, Texas, Utah and Wyoming, thus covering entire country; prohibits use of fuel oil for weed sprays; permits transfer of fuel oil for space heaters which have been acquired under Ration Order 9; (*see NPN June 30, p. 12 for complete text*); issued 6/23, effective 7/8.*

SECONDARY RECOVERY—SO 6 to PAO 11 as amended June 30—Restrictions clarified to permit secondary recovery operations only to operator who actually conducts specific injection program or to those who contribute money, property or services; also, operations must be conducted within radius of 2000 ft. of any air or gas injection well or within radius of 1000 ft. of any water injection well; issued and effective 6/30.

OPA—Office of Price Administration

FUEL OIL RATIONING—RO 11, Am. 67—Ration banking plan extended to fuel oil; primary suppliers must open at least 1 account for all establishments included in registration, or separate accounts if desired, during month of July; dealers must open at least 1 account in July if they have sold at least 250,000 gal. during any 12 consecutive months following June 1, '42 (if not eligible in July, they must open account within 30 days after becoming eligible); other dealers may open an account if they have sold at least 35,000 gal. in any 30-day period; consumers who receive deposit certificates from rationing board must open an account on or after July 1; unit value coupons of Class 4, 5 or 6 sheets must be deposited by dealers and suppliers by following dates: No. 1—Feb. 2, '44; No. 2—Mar. 8, '44; No. 3—April 13, '44; Nos. 4 and 5—Oct. 30, '44; definite value coupons may be deposited at any time; issued 6/30, effective 7/1.

RO 11, Am. 68—Rationing procedure simplified; use of validating stamps and inscription of serial numbers eliminated, as well as return of coupon sheet stubs and delivery receipt stubs; dealers' records of base period deliveries must be kept for 2 years, not 1; owner's certification of accuracy where application for heat and hot water ration is made by tenant is not required; ration record cards eliminated for primary suppliers who are also consumers; rations may be transferred to members of same family who will use fuel oil for same equipment; issued 6/30, effective 7/1.

RO 11, Am. 69—Coupons for each period of 1943-44 heating year will be valid throughout entire next period: first period coupons become valid on July 1 as well as all definite value coupons; 1943-44 rations will be issued to consumers on basis of 1942-43 rations, and will be adjusted by board according to new formula which increases allowable floor area for private dwellings and alters maximum and minimum of the range; issued 6/30, effective 7/1.

RO 11, Supp. 1, Am. 6—Class 4, 5 and 6 coupons will be used during 1943-44 heating year; value for 1 unit of first period coupons is set at 10 gal.; issued 6/30, effective 7/1.

GASOLINE, AVIATION—GMPR, SR 1, Am. 16—Contract summaries not required for aviation gasoline and synthetic rubber; issued 6/29, effective 7/6.

GASOLINE RATIONING—RO5C, Am. 56—Person who acquires gasoline solely for his own use is not considered licensed distributor if he applies for permission to operate as consumer; emergency receipts may not be deposited in ration bank account; issued 6/29, effective 7/1.

RO 5C, Am. 57—Unused transport rations must be surrendered to ODT district office within 5 days of expiration, instead of to issuing board; dealers in restricted area must surrender to distributor or board before Aug. 5 old type T coupons received before July 26; dealers outside this area must surrender before July 11 T coupons received before July 1; distributors must deposit such coupons within 10 days of expiration date; Class A coupons must be surrendered by dealers within 10 days of expiration date, and be deposited by distributors within 20 days of expiration date; issued and effective 6/29.

RO 5C, Am. 58—Mileage lost by defense workers in restricted area (north of North Carolina on East Coast) when B and C coupons were cut to 2½ gal. will be restored by board on certification of need by Plant Transportation Committee of defense plant; issued and effective 6/28.

RO 5C, Am. 59—Provisions made for rations for volunteer government workers such as firemen, policemen and OCD workers; regulations tightened, however, on rations for other government workers by requiring certification of preferred mileage driven in performance of official business; issued 6/30, effective 7/7.

RO 5C, Am. 60—Dealers and distributors must write in on coupon sheet (Form OPA R-120) the business address of particular filling station or facility from which transfers were made in exchange for attached coupons; issued 7/2, effective 7/8.

RO 5C, Am. 63—OPA officials or members of federal, state, county or local governments are authorized to demand for inspection tire inspection records, gasoline coupon books and other evidences in order to determine violations of ration order; issued and effective 7/2.

LUBE OIL—RPS 88, Am. 111—Approval of maximum price must be received from OPA before a sale may be made of waste or re-refined lubricating oil for use as fuel oil when product was not so sold during base period; issued and effective 6/26.

PRICE INCREASES—GMPR, SR 15, Am. 8—Adjustments in prices of products governed by GMPR may be made on basis of wage increases approved by WLB before April 8, 1943 if increased labor cost cannot be absorbed out of profits and if increase is not passed on by purchaser; application must be made by July 21; issued 6/29, effective 7/6.

TIRE PRICES—MPR 414—Specific maximum prices set for supplying of tire mileage and servicing of tires and tubes furnished to bus and taxicab operators under tire mileage contracts; issued 6/26, effective 7/2.

RPS 63, Am. 12; **RPS 66,** Am. 3; **MPR 107,** Am. 10; **MPR 165,** Am. 24—Supplying of tire mileage governed by MPR 414, and removed from other tire pricing orders; issued 6/26, effective 7/2.

TIRE RATIONING—RO 1A, Am. 36—Limit of 5 permitted transfers of Part B of rationing certificates removed from regulations; issued 6/29, effective 7/6.

RO 1A, Am. 35—Restrictions tightened on tires for holders of A gasoline rations; in gasoline shortage area they are eligible for new tubes or recapping only; elsewhere they may receive Grade III tires if car is used for occupational mileage, otherwise only new tubes; issued 6/29, effective 7/1.

WPB—War Production Board

ANTI FREEZE CONTAINERS—L-307—Containers of less than 5 gal. capacity may be used for no anti-freeze except glycol; issued and effective 6/26.

ODT—Office of Defense Transportation

TRUCKS—GO 21, Am. 8—Trucks exempt from requirement to carry Certificate of War Necessity when certificate is in possession of ODT or OPA; issued and effective 6/30.

BIR—Bureau of Internal Revenue

SALARY INCREASES—Plan set up by Bureau for increases for salaried employes on 48-hour week when their compensation is equal to or less than that of highest hourly paid employe; plan may be followed for all salaried positions between highest hourly rated employe receiving overtime and highest salaried position for which overtime is required; additional compensation may be paid at same rate at which it is paid to highest hourly paid employe; approval of Treasury Department is required in all cases except where present overtime payment plan was in effect on Oct. 3, 1942; (*see story on p. 16*); issued 7/1.

RFC—Reconstruction Finance Corp.

PETROLEUM RESERVES CORPORATION—Corporation set up to "buy or otherwise acquire reserves of crude petroleum from sources outside the United States, including the purchase or acquisition of stock in corporations owning such reserves or interests therein, and to store, transport, produce, process, manufacture, sell, market and otherwise dispose of such crude petroleum and the products derived therefrom; . . . . and to construct and operate outside the United States such refineries, pipelines, storage tanks and other facilities as are necessary in connection with carrying out the objects and purposes of the Corporation as above stated." Total capital stock will be $1,000,000 of one class having a par value of $100 per share and issued for cash only. Issued 6/30.

*Not released on date of issuance.

Official Text of Important Orders

New Plan Governs Redistribution Of Surplus Materials

TITLE 32—NATIONAL DEFENSE
CHAPTER XIII—PETROLEUM ADMINISTRATION FOR WAR
PART 1575—PETROLEUM INDUSTRY
PAW MATERIALS REDISTRIBUTION PROGRAM NO. 2

The fulfillment of the requirements for the defense of the United States has created a shortage of materials necessary for the production of petroleum for defense, for private account, and for export; and the following program is deemed necessary in the public interest, to promote the national defense, and to provide adequate supplies of petroleum for military and other essential purposes by making possible the fullest utilization of existing materials in the petroleum industry:

Section 1575.2 (*PAW Materials Redistribution Program No.* 2).

(a) *Purpose.* The purpose of this Program is to effect a redistribution of certain critical materials among petroleum operators, so as to assure maximum efficient use of these materials and continued effective operation of the petroleum industry. In addition this Program is designed as a method for determining the extent to which overall surpluses of material exist in the petroleum industry and are available for other uses in this country's war program. These purposes are

to be accomplished through the establishment of uniform procedures for the reporting and sale or exchange of surplus stocks owned or controlled by petroleum industry operators.

The issuance of this Program supersedes the previously operative "Tubular Goods Program" and establishes uniform standards for the recording and redistribution of those items of material essential to the war program which from time to time may become critical.

(b) *Definitions.*

(1) "Operator" means any person to the extent that he is engaged in the petroleum industry.

(2) "Petroleum Industry" means any operation directly incident to:

(i) The discovery, development or depletion of petroleum pools (production);

(ii) The extraction or recovery of natural gasoline and associated hydrocarbons (natural gasoline production);

(iii) The transportation, movement, loading or unloading of petroleum other than natural gas (transportation);

(iv) The processing, refining or compounding of finished or unfinished petroleum products (refining);

(v) The distribution or dispensing of petroleum products (other than natural gas) and the storing of petroleum products incident thereto (marketing); and shall include for each of the above listed branches of the industry, to the extent applicable therein, the investigation into more efficient or more effective methods of conducting petroleum industry operations by means of research or technical laboratories.

(3) "Material" means any commodity, equipment, accessory, part, assembly, or product of any kind.

(4) "Surplus Material" means with respect to each operator that quantity of any item of material, usable for purposes other than scrap, in the operator's possession or under his control which is determined to be surplus critical material in accordance with Schedules "A", "B", or "C"; or which (with respect to any material not identified as critical material) exceeds the quantity required or scheduled for use during the succeeding 90 days.

(5) "Critical Material" means the material identified as critical on Schedules "A", "B", or "C" of this Program.

(c) *Participation in the Redistribution Program.*

(1) *Required Participation.* Every operator (except marketing operators who neither operate five or more bulk plants nor own or control marketing equipment with a new replacement cost of $300 or more at each of 25 or more retail outlets) who after July 31, 1943 acquires any material through the use of priorities assistance, for use in the United States, its territories or possessions must participate in the Redistribution Program.

(2) *Voluntary Participation.* Any operator, domestic or foreign (although not a required participant), and any supplier may participate in this Program by following the provisions of the Redistribution Program as if he were a required participant.

(3) *Classes of Participation.* At any time the Petroleum Administration for War may include or exclude any operator or class of operators from required participation in the Redistribution Program.

(4) *Required Certification.* At the time of filing this first report, or in the case of a required participant having no surplus material to report, on or before July 31, 1943, each operator shall file with the District Office for each District in which he operates a certification in triplicate in substantially the following form:

This is to certify that I am acquainted with the provisions of PAW Materials Redistribution Program No. 2 and have filed and will file all reports required thereunder.

Name of Required Participant

Address

Date

Branch or Branches of Industry
in which Operations
are Conducted in District

(d) *Material Covered by the Redistribution Program.*

(1) The Redistribution Program covers all critical material which exists in the petroleum industry.

(2) Only surplus critical material must be reported. However, any item of critical material may be reported when a substantial quantity of such item exists at any location. In the event that critical material is reported, whether or not such material is surplus material, it shall be considered as surplus critical material for the purpose of this Redistribution Program.

(3) Where surplus critical material is jointly owned or controlled by two or more operators, such material shall be included in the program and reports as to such material shall be made by the operating owner.

(e) *Surplus Critical Material Reporting.*

(1) *Initial Inventory.* As soon as possible, every required participant shall make surveys of his critical material to determine what surplus critical material he has in his possession or subject to his control. A separate survey shall be conducted for each PAW District.

(2) *Critical Material to be Reported.* Surplus critical material must be listed on PAW Form No. MA-3-A, and reported on this form to the District Office of the Petroleum Administration for War for the District in which the surplus critical material is located. The first report shall be made on or before July 31, 1943.

The operator must fill out a separate PAW Form No. MA-3-A for each item or group of identical items which are owned or controlled by a required participant and are located at one place. However, where the required participant has like items of material located at two or more places in the PAW District, he may submit one report for all like items and list the identifying locations of the critical material on the back of the form. Three copies of Form No. MA-3-A shall be sent to the appropriate District Office and one shall be retained by the operator to be maintained as an inventory record so established that he can conveniently answer inquiries concerning his surplus critical material.

(3) *Maintaining Current Records.*

(i) *Adjustment of Schedules.* In the event that an item of critical material is added to or withdrawn by the Petroleum Administration for War from Schedule "A", "B", or "C", an appropriate adjustment is required. When an item is added, a required participant must immediately conduct a survey (in the manner prescribed in subparagraph (1) above) of that item to determine whether or not with respect to that item he has in his possession or subject to his control any surplus critical material. If the survey reveals the existence of surplus critical material, he shall immediately notify the appropriate District Office on PAW Form No. MA-3-A in accordance with subparagraph (2) above.

Where an item of critical material is withdrawn from Schedules "A", "B", and "C", the required participant need not conduct periodic surveys of that item as described in (ii) below, nor will that item continue to be considered as subject to the requirements of the Redistribution Program which are applicable to critical material.

(ii) *Periodic Reports.* In order that the records of the Petroleum Administration for War may be maintained on a current basis the following interim reporting procedure should be used:

(a) When any item of critical material is acquired by a required participant in an amount which will result in surplus critical material for that item, he will immediately notify the appropriate District Office of this fact on PAW Form No. MA-3-A, in accordance with subparagraph (2) above.

(b) When any item of critical material is used or disposed of by a required participant and as a result there no longer exists surplus critical material with respect to that item, he will immediately notify the appropriate District Office of this fact on PAW Form No. MA-3-A in accordance with subparagraph (2) above.

(c) When the quantity of any item of surplus critical material reported by a required participant is altered in an amount greater than 25% of the total reported surplus of that item, the required participant will immediately notify the appropriate District Office of this fact on PAW Form No. MA-3-A in accordance with subparagraph (2) above.

In any event, a required participant will review his stock position and list or report any alterations in his surplus critical material inventory position at least once every 90 days. The first of these reviews and reports will be completed and submitted (to the appropriate District Office on PAW Form No. MA-3-A, in accordance with subparagraph (2) above) on or before October 31, 1943.

(iii) *Current Records.* The inventory and inventory records of any required participant may be reviewed by representatives of the Petroleum Administration for War at any time to determine conformity with the requirements of this Redistribution Program.

(f) *Use of Inventory Records to Obtain Critical Materials.*

(1) *Action to be Taken by an Operator Requiring Critical Material.*

(i) Whenever a required participant requires the delivery of any critical material, the operator must, in an effort to locate the material, first consult his own inventory records for the District in which the critical material is to be used.

Where an item of critical material is withdrawn from Schedules "A", "B", and "C", the required participant need not conduct periodic surveys of that item as described in (ii) below, nor will that item continue to be considered as subject to the requirements of the Redistribution Program which are applicable to critical material.

(ii) *Periodic Reports.* In order that the records of the Petroleum Administration for War may be maintained on a current basis the following interim reporting procedure should be used:

(a) When any item of critical material is acquired by a required participant in an amount which will result in surplus critical material for that item, he will immediately notify the appropriate District Office of this fact on PAW Form No. MA-3-A, in accordance with subparagraph (2) above.

(b) When any item of critical material is used or disposed of by a required participant and as a result there no longer exists surplus critical material with respect to that item, he will immediately notify the appropriate District Office of this fact on PAW Form No. MA-3-A in accordance with subparagraph (2) above.

(c) When the quantity of any item of surplus critical material reported by a required participant is altered in an amount greater than 25% of the total reported surplus of that item, the required participant will immediately notify the appropriate District Office of this fact on PAW Form No. MA-3-A in accordance with subparagraph (2) above.

In any event, a required participant will review his stock position and list or report any alterations in his surplus critical material inventory position at least once every 90 days. The first of these reviews and reports will be completed and submitted (to the appropriate District Office on PAW Form MA-3-A, in accordance with subparagraph (2) above) on or before October 31, 1943.

(iii) *Current Records.* The inventory and inventory records of any required participant may be reviewed by representatives of the Petroleum Administration for War at any time to determine conformity with the requirements of this Redistribution Program.

(f) *Use of Inventory Records to Obtain Critical Materials.*

(1) *Action to be Taken by an Operator Requiring Critical Material.*

(i) Whenever a required participant requires the delivery of any critical material, the operator must, in an effort to locate the material, first consult his own inventory records for the District in which the critical material is to be used.

(ii) When, under Preference Rating Order P-98-b or other applicable order, the delivery order or application form must be approved or an authorization granted prior to the use of priorities assistance, an operator before submitting the order or using authorized priorities assistance (other than MRO assistance for which an approved delivery order is necessary) should inquire of the appropriate District Office as to whether or not the critical material for which priorities assistance has been requested is available in the stocks of another operator.

(2) *Notification of Existence of Surplus Critical Material.* Before processing a request for priorities assistance, a check will be made by the Petroleum Administration for War of its inventory records to determine whether or not the particular item or items of critical material are otherwise available as surplus material in the hands of other operators. In the event that a determination is made that this is the case, the applicant for priorities assistance will be informed of this fact by letter, or collect telephone, or collect telegram, depending upon the expressed preference of the operator and the urgency. Letter notification will be on PAW Form No. MA-3-C entitled "Notification of Sources of Surplus Critical Material".

(3) *Negotiation for Sale or Transfer of Critical Material.* Upon receipt of notification of possible available supplies of critical material, the operator requiring the critical material will communicate with the operators indicated as possessing possible supplies and negotiate with them for the sale or transfer of the material. If the operator cannot obtain the critical material from any of the indicated sources, he will so notify the Petroleum Administration for War on a copy of PAW Form No. MA-3-C, entitled "Notification of Sources of Surplus Critical Material", giving a full explanation of the reasons why the purchase or transfer could not be consummated. A supply of these forms may be obtained from any Petroleum Administration for War District Office for use as replies when notification is made by telephone or telegraph.

Where inquiry is made by transmitting a copy of the delivery order or an application for priorities assistance, and the Petroleum Administration for War determines that the required critical material is listed as surplus stock by other operators and so notifies the operator on PAW Form No. MA-3-C, the purchase order or application will be held in abeyance for 15 days from the date of notification to the operator of the possible sources of the critical material. If the operator is unsuccessful in obtaining the critical material from the suggested sources, the original request for priorities assistance will be processed where information to this effect is received from the operator within 15 days of the date of notification. Unless the Petroleum Administration for War is so notified within the 15 days, a new copy of the delivery order or application for priorities assistance must be submitted if priorities assistance is necessary.

Before transmitting an application for priorities assistance which under Order P-98-b must be sent directly to Washington, the required participant shall unless emergency conditions prevent, request information of the appropriate District Office as to available supplies of surplus critical material located in the District and shall attempt to obtain such material without the use of priorities assistance. If material is not available the operator shall so notify the District Office and place upon his application to Washington, a statement in substantially the following form:

"Cleared with Surplus Critical Material Unit,
Materials Division, Petroleum Administration
for War District No. ——."

In the event that no contact is made with the District Office, the Petroleum Administration for War

in Washington will determine from its inventory records whether or not there exists surplus material in hands of other operators in the District and based upon the determination will, if appropriate, return to the operator PAW Form No. MA-3-C for processing by the operator in the manner specified above.

(g) *Price Negotiation.* The Petroleum Administration for War will not negotiate prices in any sales or transfers effected under this Redistribution Program nor in any way act as a collecting agency for any seller or transferor. Although the price charged should not exceed the present new replacement cost of the critical material at its present location or the applicable established maximum price, if any, of the Office of Price Administration, the Petroleum Administration for War will not check any price against such limits. The negotiation of prices and the conformity of prices with governmental regulations is the responsibility of the operator.

(h) *Forms.* Sample copies of all forms referred to in this Program and instructions for their use will be attached to the Materials Redistribution Program as distributed. Additional copies of the forms for use in carrying out the provisions of this Program may be obtained from any District Office of the Petroleum Administration for War.

(i) *Sales and Transfers Within the Petroleum Industry.* The terms and provisions of Preference Rating Order P-98-c, as amended, permit sales and transfers of material within an operator's company or between operators, and in addition permit sales or transfers by an operator to a supplier for direct sale or transfer by the supplier to another operator. However, no material may be delivered to any operator by either an operator or a supplier (where the material is ultimately to be used in the United States, its territories or possessions, or the Dominion of Canada) in a quantity "which if accepted by the operator would result in surplus material for the operator". Likewise, no operator may submit a delivery order, purchase order or contract, effect a sale or transfer of material otherwise authorized under Preference Rating Order P-98-c, or use priorities assistance, to obtain delivery of material for ultimate use in the United States, its territories or possessions, or the Dominion of Canada in a quantity which if accepted by the operator would result in surplus material.

These provisions, making possible the full utilization of this Materials Redistribution Program, also limit the quantities of material which may be accepted; and it should be the direct concern of every operator to acquaint himself fully with the provisions of the P-98-c Order in working under the Materials Redistribution Program.

(j) *Appeals.* Any operator who is subject to any requirement of any regulation, direction, or other action under this Redistribution Program may appeal for relief by filing a letter in triplicate with the District Director of Materials, Petroleum Administration for War, at the District Office for the District in which relief is sought, Ref: MRP-2, setting forth the pertinent facts, and the reasons why the operator considers that he is entitled to relief.

(E.O. 9276, 7 F.R. 10091; E.O. 9125, 7 F.R. 2719; sec. 2(a), Pub. Law 671, 76th Cong., as amended by Pub. Laws 89 and 507, 77th Cong.)

(This Program has been approved by the Bureau of the Budget in accordance with the Federal Reports Act of 1942).

Issued this 9th day of July, 1943.

Harold L. Ickes,
Petroleum Administrator for War.

* * *

TITLE 32—NATIONAL DEFENSE
CHAPTER IX—WAR PRODUCTION BOARD
SUBCHAPTER B—DIVISION OF INDUSTRY OPERATIONS

PART 1041

Production, Transportation, Refining and Marketing of Petroleum Amendment No. 1 to Preference Rating Order P-98-b, as amended May 15, 1943.

Section 1041.2 (Preference Rating Order P-98-b, as amended May 15, 1943) is hereby amended in the following respects:

(1) Subparagraph (b) (11) which reads as follows is hereby inserted:

(11) "Research laboratory material" means material used exclusively for the purpose of carrying out investigations into more efficient or more effective methods of conducting petroleum industry operations by means of research or technical laboratories, except that such material shall not include material for use in the construction of laboratory buildings or other structures.

(2) Subparagraphs (b) (11) through (b) (14) are hereby renumbered (b) (12) through (b) (15), respectively.

(3) Subparagraph (c) (2) is amended to read as follows:

(2) No operator may apply a preference rating to obtain delivery of any material specified or referred to on Schedule "C" except in conformity with the directions set forth on that schedule.

(4) Subparagraph (d) (1) is amended to read as follows:

(d) *Method of Securing MRO Material and Laboratory Equipment.*

(1) To secure delivery of research laboratory material or material for maintenance or repair purposes or as operating supplies—including without limitation controlled materials, Class A, or Class B products—an operator is hereby authorized to use allotment symbol MRO-P-98-b and a preference rating of AA-1, except for such material to be used in retail marketing (service station operations), to secure the delivery of which a preference rating of AA-5 is hereby authorized. Material delivered or to be delivered for use as research laboratory material, or for maintenance or repair purposes or as operating supplies is referred to as "MRO material".

(5) The first paragraph of subparagraph (f) (5) is amended to read as follows:

(5) Prior to placing with a supplier a delivery order bearing an allotment number and preference rating for the delivery of any material (other than MRO material) to be used in a production operation, each operator shall submit copies of delivery orders to the Petroleum Administration for War or the Office of Oil Controller, as follows:

(i) Where the total cost to the operator of all items on the delivery order is $100.00 or more, but less than $1000.00, and the cost of every item on the delivery order is less than $500.00, *one* copy of such delivery order shall be submitted.

(ii) Where the total cost to the operator of all items on the delivery order is $1000.00 or more or where the cost to the operator of any item on the delivery order is $500.00 or more, *two* copies of such delivery order shall be submitted.

(6) Subparagraph (f) (7) is amended to read as follows:

(7) In placing a delivery order bearing an allotment number and preference rating for material to be used in a production operation, no operator shall alter the customary designation of any item or subdivide an ordinary purchase of any item or items for the purpose of making it appear that an item costs less than $500.00; the total cost of all items on the delivery order is less than $1000.00; or the total cost of all items on the delivery order is less than $100.00.

(7) Subparagraph (n) (6) is amended to read as follows:

(6) To obtain deliveries of material on or after August 1, 1943 unless such operator is a participant in the PAW Materials Redistribution Program No. 2 in the event that participation by the operator in such program is required by the terms of the program.

(8) Paragraph (p) which reads as follows is hereby inserted:

(p) *Further Limitations on Use of Priorities Assistance.* The Petroleum Administration for War may issue in its own name further restrictions or limitations on the use of priorities assistance by operators in the petroleum industry.

(9) Paragraphs (p) and (q) are hereby relettered (q) and (r), respectively.

(10) Schedule "C" is amended to read as follows:

SCHEDULE "C"—SPECIAL DIRECTIONS CONCERNING CERTAIN MATERIAL AND EQUIPMENT USED IN THE PETROLEUM INDUSTRY.

An Operator may apply a preference rating to obtain delivery of the material specified on Lists A, B, and C of Priorities Regulation No. 3, as amended from time to time, only in accordance with paragraph (f) of Priorities Regulation No. 3. Each operator should acquaint himself fully with the new Priorities Regulation No. 3 before applying preference ratings made available by P-98-b.

This amendment shall take effect immediately.

Issued this 9th day of July, 1943.

WAR PRODUCTION BOARD,
By J. Joseph Whelan,
Recording Secretary.

* * *

TITLE 32—NATIONAL DEFENSE
CHAPTER IX—WAR PRODUCTION BOARD
SUBCHAPTER B—DIVISION OF INDUSTRY OPERATIONS

PART 1041

Production, Transportation, Refining and Marketing of Petroleum, Amendment No. 1 to Preference Rating Order P-98-c, as amended May 6, 1943.

Section 1041.3 (Preference Rating Order P-98-c, as amended May 6, 1943) is hereby amended in the following respects:

(1) Subparagraph (a) (2) is amended to read as follows:

(2) "Surplus Material" means with respect to each operator that quantity of any item of material, usable for purposes other than scrap, in the operator's possession or under his control which is determined to be surplus critical material in accordance with Schedule "A", "B", or "C"; or which (with respect to any material not identified as critical material) exceeds the quantity required or scheduled for use during the succeeding 90 days.

(2) Subparagraph (c) (4) is amended to read as follows:

(4) On and after August 1, 1943, no operator who is required to make a certification of compliance under the provisions of the PAW-Material Redistribution Program No. 2 may submit a contract or purchase order, effect a sale or transfer authorized by the provisions of Paragraph (b) of this order, or apply priorities assistance to obtain delivery of any material unless such certification has been made.

(3) Paragraph (d) is amended to read as follows:

(d) *Participation in Material Redistribution Program.* Where any material is to be used by an operator in the United States, its territories or possessions, such operator shall file such applications as are required by the PAW-Materials Redistribution Program No. 2 and shall participate in such program to the extent required by its terms and provisions. Any operator required to make a certification of compliance under the provisions of the PAW-Materials Redistribution Program No. 2 may be deprived of priorities assistance where a determination has been made that such operator has surplus material which he has not made available for redistribution in accordance with such program.

(4) There is added as Paragraph (h) the following:

(h) *Further Limitations on Use of Priorities Assistance.* The Petroleum Administration for War may issue in its own name further restrictions or limitations on the use of priorities assistance by operators in the petroleum industry. This amendment shall take effect immediately.

Issued this 9th day of July, 1943.

WAR PRODUCTION BOARD.
By J. Joseph Whelan,
Recording Secretary.

* * *

SCHEDULE "A"

Determination of Surplus Critical Material for this Schedule

To determine surplus critical material for Schedule A: Subtract from the total quantity of any item of critical material (of a type identified on this Schedule), that quantity by item which is required or scheduled for use during the succeeding 90 days.

Critical Material	Branch of Industry Used In
Carbon and Alloy Steel	
Tubular Goods (oil country)	
Casing	P
Tubing—2" and up	P
Drill pipe	P
Line Pipe—2" and up	P, NG, R, T
Wire Rope	P
API Steel Sucker Rods	P

SCHEDULE "B"

Determination of Surplus Critical Material for this Schedule

To determine surplus critical material for Schedule B: Subtract from the total quantity of any item of critical material (of a type identified on this Schedule), one-half of the quantity by item actually installed or put into service (use) in 1942.

Carbon and Alloy Steel	
Condenser Tubes	NG, R
Boiler Tubes	R
Still Tubes	R
Copper	
Wire (wire mill copper products)	P, NG, R
Pipe and Tubing (including tubes)	NG, R
Copper Base Alloys	
Pipe and Tubing (including tubes)	NG, R
Valves[1]	
(check, gate, globe, plug, relief, safety)	
Steel 2" and up	P, NG, R, T
Cast Iron 12" and up	P, NG, R, T

SCHEDULE "C"

Determination of Surplus Critical Material for this Schedule

To determine surplus critical material for Schedule "C": Total by item all critical material whether or not installed (of a type identified in this Schedule): (a) which has not been in productive service during the past 90 days and is not required or schedule for such service during the succeeding 30 days; or (b) which has not been in productive service during the past 180 days.

Critical Material	Branch of Industry Used In
Compressors[2]	
75 HP or more (including direct driven)	P
200 HP or more (direct driven only)	NG, R
7½ HP or less (complete with storage tank)	M

(*See REDISTRIBUTION, p.* 16)

The EDITOR'S Page

Readers comments and opinions will be much appreciated by—WARREN C. PLATT, NPN's Editor and Publisher, Penton Building, Cleveland, O.

A Higher Price or Success to the Axis Is Now Squarely Up to the New Deal

"There is an impending oil shortage in the United States."

These momentous words are those of Lieut. Gen. Somervell, Commander of the Army Service Forces, spoken at a hearing of the Senate appropriations committee last week. They are the most effective argument that the oil industry can advance for the only means of getting a sufficient supply of crude: prices that will pay the cost of getting that crude.

The direct military demand has increased in the last two years from an insignificant per cent of the country's total oil production to probably a third of the country's production.

A shortage of oil means fighting planes that stay on the ground, tanks and supply trucks that do not move or fight and civilians who walk to work and even freeze in their homes.

With this picture a coming threat, as it is, this is obviously, then, no time to try out new professorial theories of government subsidies to drillers of wildcat wells and to owners of stripper wells. With our military effort seriously threatened and our civilian transportation coming to a halt, this country cannot get after fresh supplies of oil too quickly or too vigorously.

PAW has recommended a 35c advance in the price of crude, but this is only temporizing with fate. The sooner crude is put at an average of $2 or even $2.50 a barrel, the sooner the drillers will be started for more oil, and the sooner that is done the more likely those drillers are to find a flood of oil that will make it impossible to maintain a $2 or $2.50 price, at least for any length of time.

As was pointed out in an editorial last week in NPN, most of the advance in the price of crude will be paid directly by government in its purchase of petroleum supplies and through the prices for munitions that it pays to manufacturers and other large consumers of petroleum supplies. Relatively little of that increased cost would fall on the public, and that little would be but a few dollars a year to the average car- or home-owner using oil for heating. Such few dollars would have no bearing whatsoever upon any real inflation.

The very people who are making the most surplus money out of the war effort, over their normal living expenses and which surplus money is threatening this country with a real inflation, are the ones who would be called upon to pay $4, $5, or in some cases $10 more a year for their gasoline, and $10 or $20 more a year, perhaps, for their fuel oil.

An advance in the price of crude oil and of petroleum products, to cover the necessary additional expense to go get the oil that this country so direly needs, therefore, would have just the opposite effect from that claimed by the radical New Dealers. Such advances would absorb an infinitesimal fraction of this idle money, and to that extent help to head off inflation.

The administration at Washington is fast getting pushed into a position where it will have to decide whether to tell the unioneers, whose votes it has been so ardently soliciting, in fact buying, that the days of soft money are over, and there will be no more wage increases, or else launch this country into a spiral of real inflation.

In the meantime the Army and the Navy and our allies, by their successful prosecution of the war effort, are in increasing need of more oil. The question is: "Will the New Deal supply the oil by taking its professorial hand off of price, or will the New Deal decree that the planes shall stay on the ground and the tanks and jeeps and other equipment not roll and the ships stay tied up to dock?"

Farm Machinery Program Backed by Independents

THERE is being held today at Kansas City, as this issue goes to press, a meeting of independent oil men in support of the cooperative effort of PAW Ickes and the Food Administrator and the Agricultural Department to the end that the oil industry do all possible to see that the farmer gets the best work out of his machinery in this dire food crisis.

That meeting is being held by the sales organization of the small refiners in Kansas and Oklahoma, known as Sovereign Service, and is under the leadership of the creator and manager of that service, C. R. Sullivan of Wichita, Kans.

That meeting is being attended by official representatives of oil and food and farm agencies from Washington, as well as representatives of the agricultural schools and state departments of the Mid-West and those of the independent oil companies whose job it is to increase the efficiency of the industry's farm machinery maintenance campaign.

The oil industry has long done a good selling job to the farmer, but no selling job is ever perfect. For evidence of that, so far as farm equipment is concerned, look at the condition of so much of that equipment and hear the stories of those who have to repair it.

More selling of oil industry farm machinery service, more selling of the oil industry's lubricating products, more selling of the right fuel and accessories, will bring still longer life to this equipment, fewer breakdowns, and better performance.

This joint program, that PAW Ickes proposed to the Food Administrator several months ago, could well be taken up by every oil marketing association. The more it is discussed at state oil marketing meetings the more effectively this educational campaign can be carried on.

Reports from Washington are that the seriousness of the food situation should not be under-rated. So every oil man, as he supports this cooperative farm machinery maintenance program, is making a direct contribution to more food for himself and the general public.

More Companies Seek Tax Relief For Postwar Rehabilitation

SUPPORT grows for the idea that there should be such exemption from the extreme severity of corporation taxes as will permit companies to have on hand at the end of the war sufficient cash to convert to peacetime products and efforts.

The top officers of Republic Steel Corp., in their annual report, urge the need of companies accumulating money surpluses for postwar development. The magazine *Business Week*, in an editorial discussing the renegotiation of war contracts, also urges the need of cash reserves outside of taxes for postwar reconstruction.

Earnings that have been paid to the government as taxes do not build new plants, do not discover and pioneer the development of new ideas, new methods, and new inventions.

Earnings that have been paid to the government as taxes will never develop a small business into a large business, and most American businesses have been thus developed from their own earnings, in the days, however, when taxes were relatively low.

Associations representing the small oil man, particularly, should be presenting their arguments, through their congressmen and senators, for some exemption from the present onerous income taxes if the small oil companies are to be able to buy the new and modern equipment that will be available after the war, and for the purchase of which major oil companies will, for the most part, be fairly well equipped in cash.

To this end, that there be a continuation of real competition in the oil industry, the major oil companies, in their quarterly statements and whenever opportunity offers, should be treating their income taxes just the way they have treated their gasoline consumer taxes—that is, set them out as money collected for the benefit of the government, and not money earned for the benefit of the company.

Protests OPA Kangaroo Court Operations

THE plight of the small business man who tries to find out what government regulations mean and then tries to conform to them is well presented by the protest of Secretary Morrill of the Atlantic Coast Oil Assns. Conference to OPA Chief Brown, as given below.

Secretary Morrill opens the whole subject of fair and lawful enforcement of multitudinous government regulations. His protest also questions the fairness of what amount to kangaroo courts and drumhead court martials, such as have been conducted and threatened by OPA, particularly.

The government has reached a point where it will have to decide whether to use education and moral suasion, with prosecutions only in the most flagrant cases and then only in the regular courts, or to pull a series of kangaroo-court operations similar to what we had at the inauguration of prohibition. These operations soon put the radical prohibition enforcers under such a cloud that the temperance movement lost much that it had gained in the last hundred years.

Any similar tactics applied by OPA or other government agencies in the present emergency will also quite likely still further bring those regulations and their would-be law enforcers into similar disrepute. This means that the public will quit trying to obey those rules and regulations that it does not understand or agree to as fair and reasonable.

When prohibition was inaugurated the public finally learned what every good police officer has long known—that it takes years to teach a good man to be a good policeman, and during those years he has to be part of a system that is well disciplined. Recruits must be guarded that they do not have opportunity to exercise their untrained judgment against those over whom they may have jurisdiction. Police departments also try to weed out those obstreperous individuals who always want to "put the law on you."

OPA and other government war agencies operating largely under executive decree, with none-too-good legal authority at best, have accumulated a lot of amateur cops and prosecuting officers. Unfortunately, to a large extent, these particular individuals are temperamentally and by training least fit to exercise the responsibility placed upon them. They have continually shown their unfitness and their disregard of the rights of others in the nonsensical regulations that they have so frequently arbitrarily concocted and sought to force on American citizens.

The public has been most tolerant toward these amateur dicks because of its sincere, loyal interest in winning the war. But it undoubtedly is high time to call the amateur cops to account for their methods of enforcing these so-called laws. Acting Gov. Goodland of Wisconsin was protecting the rights of citizens against kangaroo-court operations when last week he ordered state police officers not to lend their aid to OPA investigators who wanted to stop motorists on public highways to question them and then haul them before other OPA-ers for "trial".

There has been quite a bit of such practice over the country, and a patient public has stood for it. But were the practice to be permitted without limit it is only a question of time before the public would be deprived of many of its rights under the "four freedoms". Stopping anyone who is on his "lawful occasions" on the public highway at the will of an OPA investigator, when the investigator has no knowledge as to whether the law has been violated or not, is quite similar to the invasion of one's home in search of possible evidence, but without a search warrant, the prohibition of which is one of the most important fundamentals in our Constitution.

Secretary Morrill of the Atlantic Coast Oil Assns. Conference was speaking on behalf of the rights of every business man in his appeal to OPA Chief Brown to give his agency's enforcing activities a thorough overhauling. Such an overhauling should get OPA and other war agencies back to practicing before the recognized legal machinery of the country, and to trying their so-called cases before the established courts of the country and under the rules of court procedure as set forth by Congress and legislatures.

Text of Morrill's Letter to OPA Chief Brown

June 30, 1943

Mr. Prentiss M. Brown, Administrator,
Office of Price Administration,
Washington, D. C.

My Dear Mr. Brown:

Reports indicate that the Legal Division of O.P.A. is instigating prosecution of approximately 70 fuel oil distributing firms in District No. 1 who allegedly violated last year's Fuel Oil Ration Order.

This Order, experimental and hastily prepared, now carrying 65 amendments, delayed beyond all reason in execution and necessitating issuance of temporary certificates, was complicated and confusing. During the winter it was in direct conflict with orders issued by P.A.W. With every will to cooperate with its provisions, fuel oil distributors in our large cities found office and delivery help unavailable that might have carried the additional load that was thrust upon them. Violation was inevitable if they were to keep the families warm that looked to them for delivery of oil. Mistakes of rationing boards alone caused untold addition in man hours for every fuel oil distributor.

Large integrated companies with large reserve resources in employees and money had a distinct advantage. Further, their large legal staffs were constantly alert to interpret the Order. Small distributors have no such reserves and cannot afford such legal advice, yet they serve 75 to 80% of the consumers on the Eastern Seaboard.

Wholesale prosecution, therefore, hits these Independent distributors first, the size and ability of integrated companies' legal staffs serving to direct an enforcement attack towards small units for the sake of speed in conviction for publicity reasons.

So far the pattern of punishment has been suspension of business activity ordered for a term of 30, or 60, or 90 days; a truly unrealistic penalty, since it is all out of proportion to the violations involved under the circumstances. A suspension of this kind drives the business of the small distributor into the arms of the large integrated company, convincing the consumer that only there can his interests be safe. A lifetime of business building is jeopardized because a confused, inadequate, and conflicting Order was forced on the small distributor who, through no fault of his own, could neither interpret it nor find employees to administer it.

If an enemy were to bomb our cities their objective would be to upset essential distributive services. I submit that the contemplated extended prosecution of small oil distributors, with the resultant suspension of their activity, achieves that objective better than enemy bombing.

Obviously, all the companies who violated cannot be prosecuted. Your legal staff could not assume that burden. Therefore, those selected—and it is pertinent to ask who selects those now being prosecuted and why—are persecuted if all their competitors are not likewise so prosecuted. The publicity surrounding such cases will rebound to the benefit of every company who escapes attention and, most particularly, the large companies. Hearings on violations are unfairly brought and unfairly publicized for the defendant is adjudged guilty before the hearing is opened.

We therefore request most urgently that a complete survey be made of this situation, in which Industry members on your Advisory Committee may have a part, establishing a policy that will relieve honest business organization of the job of defending their existence at a time when their every energy is needed to continue their consumer delivery service. No other course is possible if true cooperation between business and government during the war is to continue. No other move can get business working with O.P.A. No other way can be the American way.

Your business viewpoint apparent in the recent policies of O.P.A. leads us to believe that you will recognize the justice in this request. We urge that it receive prompt attention.

Very truly yours,
(s) Clyde G. Morrill
Secretary

CROWN
is in this picture TWICE

No, none of the more familiar Crown products of peacetime are on view!

But the canisters that hold the filter elements for those gas masks are a Crown wartime product . . . produced by the million in the Crown plant to safeguard military, naval and civilian users.

And those waterproof metal ammunition boxes are another Crown product . . . another example of the way all of Crown's facilities have been enlisted in the service of a nation at war!

Meanwhile . . . the less dramatic but no less necessary products . . . cans in which to pack food for fighting men and for the home front . . . cans for the essential products which can not be successfully packed in other ways . . . continue to roll from Crown's production lines! Crown is doing double duty these days!

CROWN CAN COMPANY, New York • Philadelphia. *Division of Crown Cork and Seal Company,* Baltimore, Md.

★ ★ ★ ★ ★ CROWN CAN

IRB Joggles Supervisor Pay

New 'Formula' Is Obscure, Like Predecessors in 48-Hour Regulation; Keen Mathematician Can Figure It Out After Plenty of Pencil Chewing

NPN Staff Special

WASHINGTON — Internal Revenue Bureau has again changed—but isn't telling exactly—its "formula" for determining allowable pay increases for the supervisory employes going to a 48-hour week. But the "formula" can be figured out roughly from the IRB announcement of July 1, after pencil-chewing calculations.

Basically, the revenue bureau hasn't budged from its position that a supervisor shouldn't get the same dollar increase for the extended work week as the hourly paid employes under him—unless his compensation was the same or less than theirs.

This was the first public statement on the matter since President Roosevelt's "hold-the-line" order of April 8 stymied pay hikes for foremen and other supervisors even though the men under them were given a 30% increase for the extended work week.

Statement was by Internal Revenue Commissioner Helvering. Only one point was really clear:

If a supervisor was getting the same—or less—compensation as the highest-paid hourly employe under him, then the supervisors can be paid time-and-a-half for each hour over 40 per week, just like the employes who are subject to the wage-and-hour law.

As to increases for higher-paid supervisors, the Helvering statement seemed intentionally vague and complicated. It reiterated "that no set rule may be established for determining such amounts (of allowable pay increases for supervisors), because of variations or differentials . . ."

On higher-paid supervisors, the Helvering statement said "the highest participating pay level in direct line of supervision and the minimum additional compensation necessary for that level shall be determined to the satisfaction of the Commissioner. The amount allowable to the highest rated hourly employe will then be progressively reduced for the several intervening pay levels in such manner that each succeeding higher level receives a proportionately lesser amount, until the minimum amount allowable for the highest participating pay level as previously determined is reached."

That statement is unnecessarily complicated. What the IRB says to the employer is: Take the highest level of supervisors you want to give pay increases to, decide what the minimum amount of increase for that highest level is and then grade the increase upward as you go down through the levels of supervisors.

That procedure throws upon the employer the responsibility of deciding the amounts of increase for which he seeks IRB's approval to pay. He is still in the dark though about the "maximum" which IRB will allow. Apparently, IRB wants it that way.

Maybe 'Doodlebug' Would Help

Despite Mr. Helvering's apparent intent to hide the IRB's "formula" for maximum allowable increases so that only a high-priced lawyer can find it, NPN believes that the door can be opened to his secret. And it doesn't take calculus to do it, just a bit of guessing and figuring.

First, it should be remembered that the revenue bureau's earlier formulas have always provided that no supervisor should get the same dollar increase as those under him. (An implied exception has been spelled out in Mr. Helvering's statement, namely, that if a supervisor gets the same or less, then he can get time-and-a-half for overtime.)

Next, try a few experimental pay increases, working from the top down as per Mr. Helvering's complicated explanation. After a while, it's possible to hit upon a figure for the top man which will give a steady progression upward in amounts as you go down to the lowest paid supervisor, who will be at or below the rate of the highest paid hourly employe.

Study of these figures will show that the same results will be obtained, if the dollar increase to the highest paid hourly employe is divided by the number of supervisors who are to get a pay increase. (Don't forget to count the supervisor at or below the highest-paid hourly employe. Even if the employer has no supervisor at that level, he shouldn't forget that the Helvering statement assumes that the first level of supervisors is at that point.) Dividing the dollar increase by the number of supervisors gives an amount equal to the maximum allowable increase to the top man among supervisors chosen for pay hikes. The supervisor next below him will get twice that amount; the third, three times that amount and so on.

Worked Out in Figures

Let's work it out in a specific case. Suppose the highest paid hourly worker has been increased from $300 to $390 per month (30%) with time-and-a-half for overtime when he went from 40 to 48 hours per week. All supervisors in the plant get more than $300 per month, so none can be increased on a time-and-a-half basis. The employer wants to increase the three lowest levels of supervisors who were getting $350, $400 and $450, respectively, for a 40-hour week. They have gone to 48 hours but haven't been increased yet.

What is the maximum increase which the revenue bureau would stand for according to Mr. Helvering's "formula" buried in his July 1 statement?

Take the $90 increase for the highest-paid hourly worker and divide it by 4 (don't forget that IRB assumes a supervisor at or below the hourly employe's rate). That gives $22.50, which is amount for the top supervisor getting an increase, so his monthly salary could be increased from $450 to $472.50. The second highest could go from $400 to $445; and the third, from $350 to $417.50.

REDISTRIBUTION

(*Continued from p. 12*)

Control Instruments[1,2]	
Industrial (including regulators and control valves)	NG, R
Electric Motors	
10 HP or more	P, NG, R, T
5 HP or more	M
Electric Motor Controls	
10 HP or more	P, NG, R, T
5 HP or more	M
Engines[2]	
Multi-cylinder Gas and Gasoline	
10 HP or more	P, NG, T
Diesel	
150 HP or more	P, NG, T
Heat Exchangers	
(Including complete shells)	NG, R
Line Pipe	
(Oil or gas in place)	
4" or over	P
Line Pipe	
(in place)	
4" or over	NG, T
Meters[1,2]	
Petroleum Displacement Type	N
Pressure Vessels and Towers	
200 or more cubic feet contents	NG, R
Pumps[2,3]	
Dispensing	
Motor driven meter type	M
Pumps[2,4]	
(Steam or power driven)	
Centrifugal	NG, R, T
Horizontal reciprocating	NG, R, T
Rotary	NG, R, T
Pumps[2,5]	
(power driven only)	
Centrifugal	M
Rotary	M
Pumping Units	
Oil Well (excluding standard rig front)	
10 HP or more	P
Tanks[2]	
Steel Storage	
65 gallons to 500 bbls.	M
Tanks	
Steel Storage	
10,000 bbls. or larger	P, NG, R, T
Tanks	
Steel Storage	
500 bbls. or larger	M

FOOTNOTES

(These footnotes are applicable to any footnoted material, regardless of the Schedule in which such material is listed.)

Footnoted material is considered "critical material" for the purpose of this Program only where:

(a) In the case of footnote[1], the material is unused, reconditioned or rebuilt.

(b) In the case of footnote[2], the material was sold new to any person (not necessarily to the required participant) at any time since December 31, 1937.

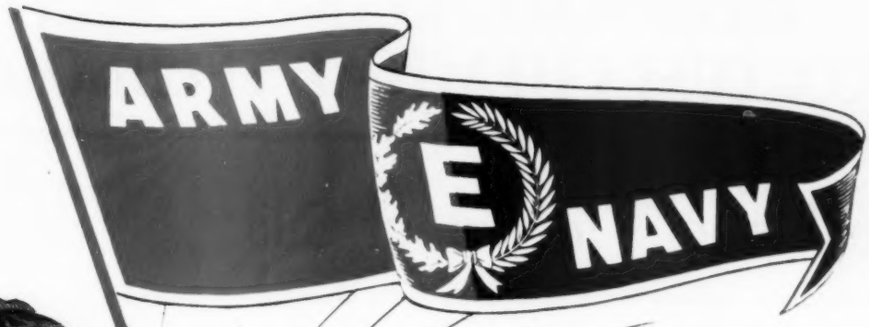
(c) In the case of footnote[3], the material is not actually installed at the time a report under the Program is submitted.

(d) In the case of footnote[4], the material has a new replacement cost (excluding the power unit) of $600 or more.

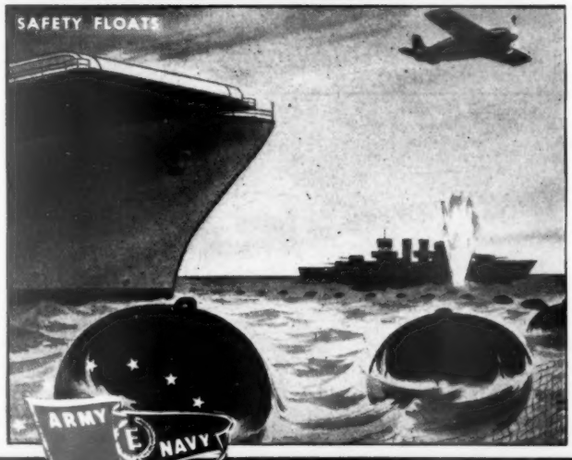
(e) In the case of footnote[5], the material has a new replacement cost (including the power unit) of $200 or more.

The symbols P, NG, R, T, and M as used in the right-hand column above have the following meanings:

P means Production (oil or gas)
NG means Natural Gasoline Production
R means Refining
T means Transportation
M means Marketing



AWARDED FOR OUR PRODUCTION SPEED IN EQUIPPING AMERICAN FORCES FOR "VICTORY"



★ ★ ★ Today, just below the Stars and Stripes, a new flag flies at Brown Steel Tank Company, in Minneapolis, Minnesota.

It is the flag of the Army-Navy Production Citation for Excellence.

By the workers, the officers and executives who operate this plant the award is deeply appreciated. The honor and recognition is a personal reward to every man and woman at Brown Steel Tank Company. It is also a source of pride to each and everyone of our suppliers. They, too, have given their wholehearted cooperation that production here might achieve this honor.

On July 6, 1943, the men and women of Brown Steel Tank Company received the "E" award with formal ceremony. Looking into the future, they pledge renewed efforts towards accomplishing even greater production that their equipment may aid in speeding "V" day — the day when we may all celebrate Victory together with our fighting men all around the globe.

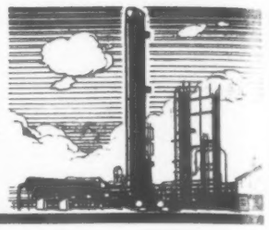
Walter H. Brown
Arthur E. Brown

BROWN STEEL TANK COMPANY

NOT AFFILIATED • ONE OFFICE, ONE PLANT • MINNEAPOLIS, MINNESOTA

DETROIT PUBLIC LIBRARY

News of REFINERY MANAGEMENT and PETROLEUM CHEMICAL TECHNOLOGY



Globe Upheld in Patent Suit

Circuit Court Affirms Federal District Court Decision in Cracking Patent Infringement Case. Court Declares Differences in Processes

NPN News Bureau

CHICAGO — The judgment of a federal district court dismissing the suit brought by Universal Oil Products Co. against Globe Oil & Refining Co., charging infringement of two cracking patents, has been affirmed by the U. S. Circuit Court of Appeals for the Seventh Circuit. The circuit court's opinion was handed down June 30 on appeal from U.O.P. The district court's opinion was announced July 24, 1941.

The affirmation of the lower court's opinion by the circuit court, however, is based on a somewhat different interpretation of the claims of one patent than was made by the lower court. The issue involved claims to prior rights to vapor phase cracking. The district court had held that Patent No. 1,392,629, granted to Carbon P. Dubbs Oct. 14, 1921, and assigned to Universal, was valid but not infringed by Globe and that Patent No. 1,537,593, granted to Universal May 12, 1925, upon application of Gustav Egloff, was not valid.

Hinges on Word 'Vaporization'

The charge of infringement of the Dubbs patent involved the definition of "vaporization" as applied to the reaction taking place in the furnace. Claim 7 of the Dubbs patent, a typical claim, reads: "A process of cracking oil consisting in continuously passing a stream of oil through a series of tubes seated in a cracking zone where the oil is heated to the crackilng temperature, *but substantial vaporization prevented* (Italics are NPN's) and thence to an enlarged vapor chamber where vaporization takes place . . . ."

Both parties to the suit had agreed that, in the cracking process used by Globe, when the oil reaches the temperature of 940 deg. F. and runs from the cracking coils to the vaporizing chamber, it is 85% vapor.

One basis of appeal by Universal was that the district court had failed to give the proper definition to the word "vaporization" as used in the patent claim. The district court had concluded that Dubbs had tried to give a new meaning to the word after it became apparent that the ordinary meaning of the language of the patent was not sufficient. The circuit court adopted this part of the lower court's judgment and said further on this point:

Court's Reasoning Quoted

"The word 'prevented' in the phrase 'but substantial vaporization prevented' is significant. Even though the word be used relatively rather than absolutely, it is, we think, highly significant in comparing defendant's process and apparatus with plaintiff's. It points to the heart of a vital step in the Dubbs' process. In defentant's process, accuracy would require a description which said, instead of 'prevented' there was an encouragement, or at least no prevention of vaporization. And this is so no matter what meaning is given to the word 'vaporization'."

The Egloff patent had been held invalid by the district court. The circuit court without adopting or disapproving of this opinion, based its conclusion in affirming the lower court on the ground there was no infringement by Globe Oil & Refining of the claims of this patent. On this point the circuit court's opinion states:

"We cannot escape the conclusion that Egloff was dealing with a decidedly different problem. Like Dubbs, his drawings and specifications both suggest a product patent. He says his invention relates to improvement in process and apparatus for cracking oil. Although he thus refers to apparatus, his claims do not support his reference. No apparatus is described. The drawings, however, help us to understand what Egloff was doing.

Cites Difference in Methods

"Even assuming validity, it is apparent that the Egloff process is at most a narrow patent limited strictly to the steps described. It is infringed only when such steps are taken as described. Defendant not only proceeds differently by its process but the differences are both additions and elimination of steps."

Judge Lindley, while agreeing with Judges Evans and Major that the judgment of the district court should be affirmed, was of the opinion that affirmance should be on the ground that the Dubbs patent was invalid because the prior arts patents showed anticipation. He is of the opinion that, if the Dubbs patent is valid, it is infringed by the Globe Oil & Refining Co. process. He was of the opinion that the Egloff patent was invalid.

(A detailed report on the decision of the U. S. District Court in this case is to be found in NPN, July 30, 1941, p. 15).

WPB Halts 100-Octane Project At Humble's Baytown Plant

NPN News Bureau

WASHINGTON—WPB issued July 5 a stop order halting installation of additional equipment at a Baytown, Tex., refinery of Humble Oil and Refining Co.

The equipment was to include 2 catalytic cracking units for conversion of existing thermal cracking coils to hydrogenation service. The project was to produce 100-octane gasoline.

Preference ratings were revoked upon recommendation of PAW which reported that other methods of procuring the gasoline would be adopted, WPB said.

The action, it was pointed out, is a routine one and does not affect the 100-octane gasoline production program.

To Jobbers and Compounders:

TODAY THE PRESSURE IS ON!

American industry is being called upon to speed up machines to record-breaking production. Armament and material makers are boosting production records.

America's manufacturers are shouldering a great responsibility. Mechanical or other failures mean shut-downs and bottlenecks—two unpopular words in war-time America.

A lot of responsibility is on their suppliers. Jobbers and compounders have problems calling for stock oils and greases that will stand up under three-shift production schedules. They are plenty tough to answer speedily and accurately.

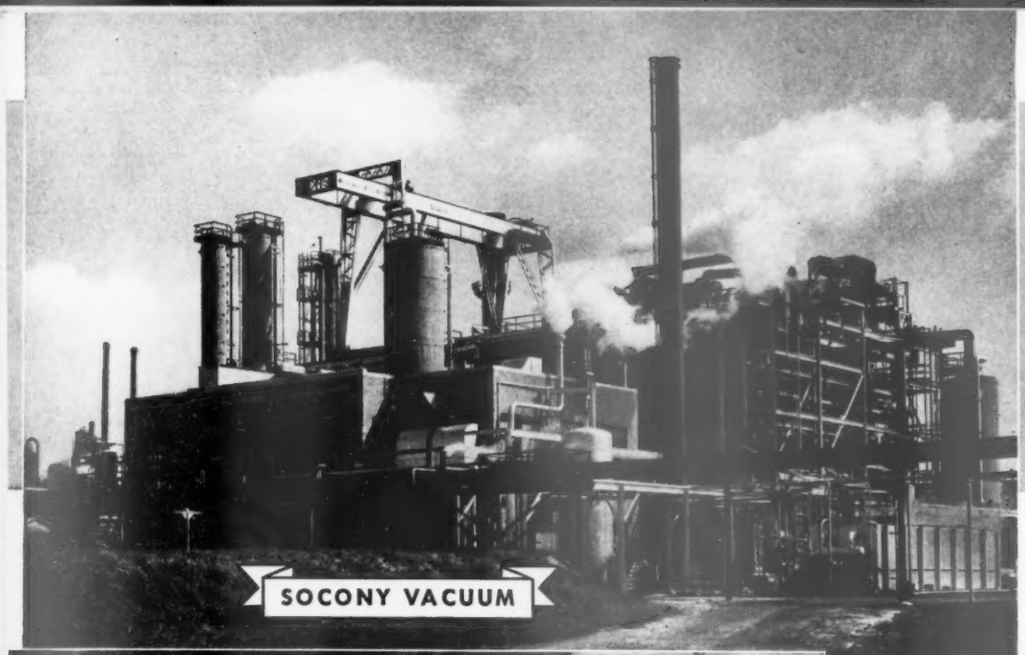
That's why we would like to offer you the Gulf "Stock Oil Service" man. He's got a wealth of experience and special knowledge to offer. There is no charge for his advice. Call him in any time you have a problem to lick.

Gulf offers a line of mid-continent and coastal oils unbeatable in quality; solvent refined Paramid neutrals and Paratex oils; and solvent refined Bright Stocks. Also acid-treated Rodessa neutrals and coastal oils.

Write or wire for samples and specifications.

Gulf Oil Corporation
Gulf Refining Company

2500 GULF BUILDING GULF **PITTSBURGH, PENNA.**



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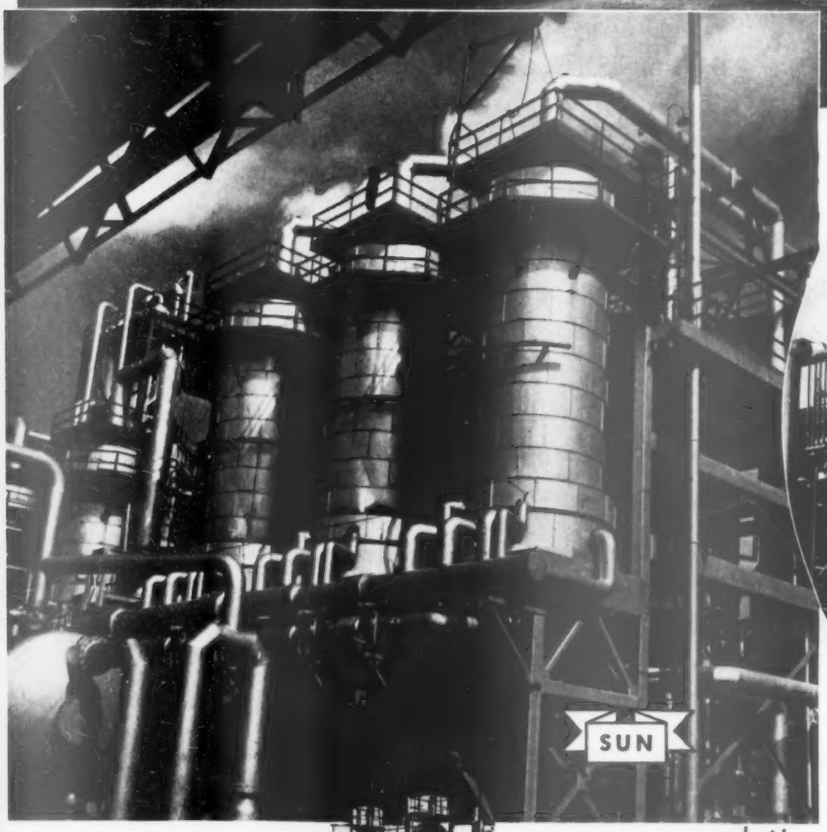
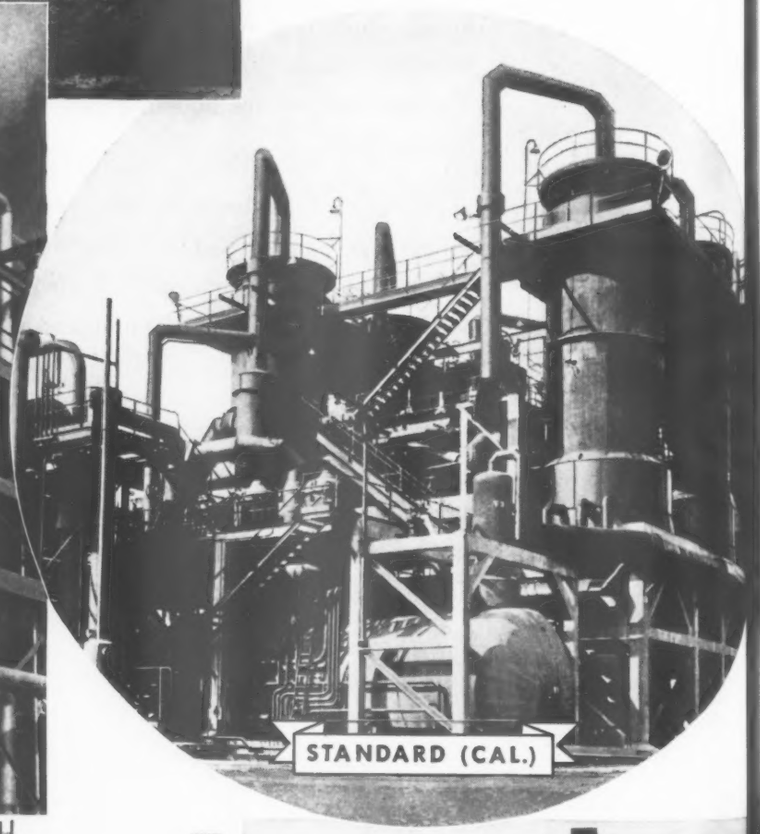
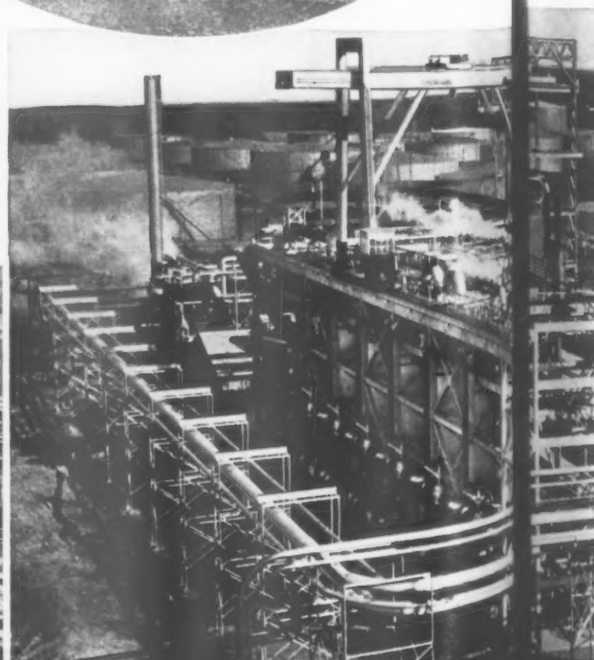






..of all catalytically cracked aviation gasoline has been produced by HOUDRY CATALYTIC PROCESSES

... FOR VICTORY IN WAR
... FOR PROGRESS IN PEACE

SIX COMPANIES, OPERATING 17 HOUDRY UNITS, HAVE BEEN THE MAINSTAY OF AMERICA'S CATALYTIC AVIATION GAS PROGRAM

The roster of refiners licensed by Houdry is a roll of honor of America's petroleum industry. Six companies, with 17 Houdry units in operation, have produced more than 90% of *all* the catalytically cracked aviation gasoline for the United Nations.

They and ten other companies (listed at the right) are building 37 additional T.C.C. and Houdry units.

Foreseeing the Needs of War

All seventeen of the Houdry units now operating were built or contracted for long before Pearl Harbor. Most of them were producing high-quality motor gasoline.

The companies operating these Houdry units were keenly aware of the convertibility of their equipment for the manufacture of aviation fuel. Working in cooperation with Houdry scientists, they made plans accordingly.

They hoped against but prepared for America's ultimate involvement in the world conflict. They foresaw the incredibly huge quantities of 100-octane aviation fuel which might be needed.

Their foresight has served America well. When war came, all existing Houdry units had been adapted, or were readily adaptable, to meet the immediate and mounting needs for high-octane aviation gas. On forty fronts, the world's finest fighting fuel has been available to help wrest air supremacy from the Axis.

History Will Remember

When this war's history is written, the world may well salute petroleum's part in Victory. And no names will be more highly placed on the industry's roll of honor than these distinguished Houdry licensees:

Ashland Oil & Refining Company	Sinclair Refining Company
Continental Oil Company	Socony-Vacuum Oil Company, Inc.
Crown Central Petroleum Corp.	Southport Petroleum Co.
General Petroleum Corp. of California	Standard Oil Co. of California
Gulf Oil Corporation	Standard Oil Co. (Ohio)
Magnolia Petroleum Company	Sun Oil Company
The Pure Oil Company	Tide Water Associated Oil Company
Richfield Oil Corp.	Union Oil Co. of California

Houdry Catalytic Processes and the Thermofor Catalytic Cracking Process are available to all American refiners, under license arrangements subject to approval by the United States Government.

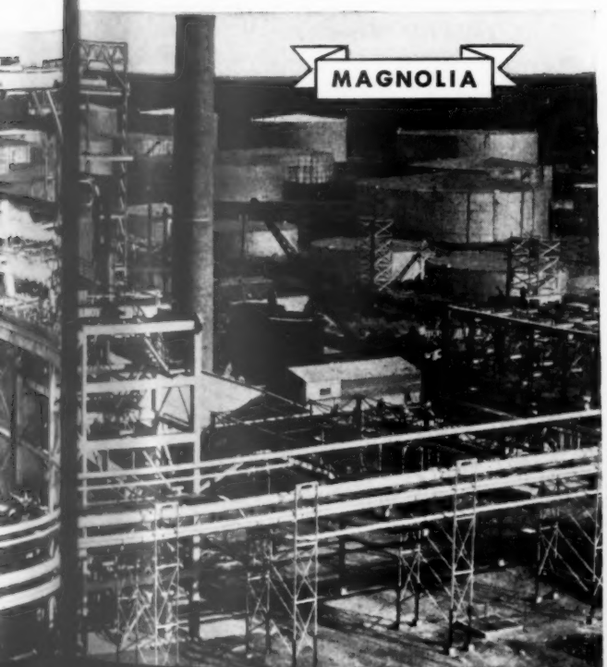
HOUDRY PROCESS CORPORATION, WILMINGTON, DELAWARE

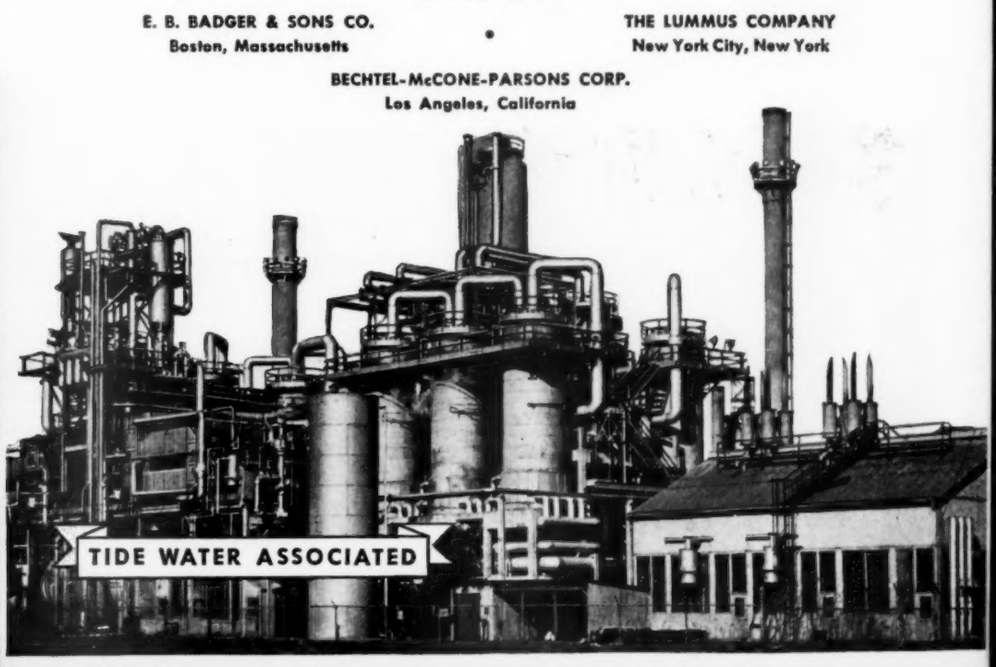
Licensing Agents:

E. B. BADGER & SONS CO.
Boston, Massachusetts

THE LUMMUS COMPANY
New York City, New York

BECHTEL-McCONE-PARSONS CORP.
Los Angeles, California





Second Quarter Demand For 'Gas', Fuel, 'Exceptionally High'

NPN News Bureau

WASHINGTON — Total demands for gasoline and residual fuel oil appear to have been unexpectedly high in the second quarter of 1943, Bureau of Mines reported July 5, with an abnormal seasonal reduction in gasoline stocks and with no substantial increase in residual stocks.

While war demands for gasoline have expanded rapidly, bureau said, civilian consumption seems to have been much greater than was anticipated. "A continuation of the high rate of gasoline demand," bureau added, "implies either a substantial gain in the yield from crude or further increases in crude runs rather than too heavy withdrawals from gasoline stocks."

Total motor fuel demand in July was estimated at 54,300,000 bbls.—6% less than actual in July, 1942, when sales were abnormally high just before the start of rationing in the East. Present yield of gasoline from crude forecast for July is 38% compared with 37% for June and 38.58% actual during July, 1942.

Crude runs to stills, which averaged only 3,617,000 b/d in the first quarter of 1943, rose to a daily average of 3,732,000 b/d in April, apparently remained close to that level in May and seem to have risen sharply in June, the bureau said, adding:

"Further increases will be essential if a substantial seasonal accumulation of fuel oil stocks is to be attained in the third quarter. Unless stock accumulation materializes, the additional supplies required to meet peak winter demands will have to depend on further increases in refinery operations and the progressive improvement in inter-regional transportation facilities."

Daily average crude production and total runs to stills during the 4 weeks May 8 to June 5, bureau reported, were 3,973,000 and 3,702,000 bbls., respectively. During this period stocks of domestic crude oil increased 107,000 b/d, indicating a demand for domestic crude of 3,866,000 b/d. This demand, bureau pointed out, reflects reductions in crude movements caused by breaks in pipelines due to Mid-West floods.

Crude Demand 4,038,700 b/d

Daily average supply of domestic crude estimated to meet market demand in July is 4,038,700 bbls.—237,200 bbls. (6%) higher than actual for July 1942.

Finished and unfinished gasoline stocks amounted to 89,482,000 bbls. on April 30, bureau said. A.P.I. statistics indicate that gasoline inventories dropped about 6,850,000 bbls. during May, which would make them approximately 82,650,000 bbls. on May 31. This is only 48.5 days' supply compared with 53.3 days' supply represented by the 94,681,000 bbls. on hand May 31, 1942. The bureau estimates a reduction in finished stocks of 2,500,000 bbls. for July, compared with 8,423,000 actual increase in July, 1942.

Benzol and direct sales of natural gasoline are estimated at 1,700,000 bbls., making an indicated refinery production of 50,100,000 bbls. distributed among the various refining districts as follows: (thousands of bbls.): East Coast, Inland Texas, Texas Gulf Coast, Louisiana Gulf Coast, inland Louisiana Gulf Coast, and inland Louisiana-Arkansas, 23,090; Appalachian, 2000; Indiana, Illinois, Kentucky, etc., 10,790; Oklahoma, 2350; Kansas, 2840; Rocky Mountain, 1300; and California, 7700.

The bureau's forecasts for July, 1943, in thousands of barrels follow:

	Forecast July '43	Forecast June '43	Actual July '42
Demand for Motor Fuel*			
Domestic Demand			
Exports			
Total Demand	54,300	51,100	57,654
Supply of Motor Fuel			
Straight Run and Cracked Gasoline Production	45,110	41,510	43,034
Natural Gasoline Used at Refineries	4,990	4,590	4,577
Total Refinery Production	50,100	46,100	47,611
Other Natural Gasoline and Imports	1,700	1,700	1,620
Decrease in Finished Stocks	2,500	3,300	8,423
Available Supply	54,300	51,100	57,654
Crude Oil Requirements			
Percent Yield of Gasoline from Crude	38.00	37.00	38.58
Refinery Crude Required	118,700	112,200	111,555
Daily Average	3,829	3,740	3,598
Domestic Crude Runs	118,400	112,000	111,153
Exports			
Fuel and Losses	6,800	6,800	6,694
Total Demand for Domestic Crude	125,200	118,800	117,847
Daily Average	4,038	3,960	3,801
Decrease in Domestic Stocks			6,605
Actual Production			111,782
Daily Average			3,605

*The term "motor fuel" as used in this report includes gasoline and naphtha used for all purposes, but does not include heavier distillates used in the operation of tractors or burned in diesel engines.

Texans Celebrate 'American-Made Rubber Day'

Special to NPN

HOUSTON—Texas assumed a position of leadership in the synthetic rubber industry July 5 with the formal opening of a 30,000-ton plant at Baytown, first in production in Texas' chain of government-financed plants rated for 255,000 tons a year and scheduled for operation this summer.

At a luncheon here Gov. Coke R. Stevenson welcomed rubber and oil company officials in ceremonies commemorating American-Made Rubber Day and celebrating the start of manufacture at Texas' first working rubber plant, which is operated by General Tire and Rubber Co.

Special tributes were paid to Secretary of Commerce Jesse H. Jones, Rubber Director William Jeffers, and the designers, engineers and scientists engaged in synthetic rubber development in Texas, which is to produce a third of the nation's synthetic rubber.

Commerce Secretary Jones addressed the luncheon guests by telephone. By the end of the year, he said, the U.S. will have its own rubber industry, with 40 plants throughout the nation, capable of meeting all essential military and civilian needs.

All the Texas synthetic rubber plants in the 255,000-ton system will make rubber from the state's petroleum and natural gas.

Butadiene will come from plants at Baytown, operated by Humble; at Borger, by Phillips Petroleum; at Houston, by Sinclair Refining, and at Port Neches, by the Neches Butane Products Co., whose constituent companies are Gulf, Texas, Pure, Atlantic and Magnolia. The largest artificial rubber plant in the national program, rated at 120,000 tons annually and built by the B. F. Goodrich Co., is at Port Neches.

Styrene will be produced at Texas City by Monsanto Chemical Co. and at Velasco by Dow Chemical Co.

"American Made Rubber Day" in Texas brought Gov. Coke Stevenson to Houston where opening of General Tire and Rubber Co.'s plant at Baytown, Tex., was celebrated. Here, Gov. Stevenson (left) talks with H. Stuart Hotchkiss, chairman of the board of the General Latex and Chemical Corp., and William O'Neil, president of General Tire and Rubber

Gulf's Philadelphia Refinery Now Producing Toluene

Special to NPN

PHILADELPHIA—Completion of a unit for the manufacture of nitration grade toluene at its refinery here was announced last week by Gulf Oil Corp.

The unit was built at the request of the Army Ordnance Department and completely with company funds, Gulf said. Raw material for the new unit is straight run gasoline obtained from existing facilities and the final product will be delivered to TNT producing plants.

DPC-California Standard Contract Announced

NPN News Bureau

WASHINGTON — RFC Chairman Jones announced July 2 that Defense Plant Corp., RFC subsidiary, has authorized execution of a contract with California Standard to provide plant facilities in California at a cost of approximately $13,500,000.

The Texas Company's policy of many years' standing is to make its patents and inventions available to the petroleum industry at prices that are reasonable.

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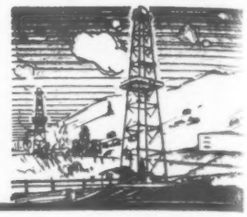

Big War Oil Demand Still Ahead

House Subcommittee, Reporting on Investigations, Sights 25% Hike in Military Oil Demand; Price Advance, Foreign Development Urged

NPN News Bureau

WASHINGTON—The Lea oil investigating subcommittee (the old Cole committee) in its report to the House July 3 warned that "the big demand upon petroleum products is yet to come" and that a crude price boost is imperative to stimulate new discoveries to meet military requirements before reserves are disastrously impaired by over-production.

The committee decried overlapping authority of OPA and PAW over petroleum that has stalled a price increase, and recommended that full control over production, supply and price of oil and petroleum products be unified in PAW.

To conserve our own reserves and to assure sufficient war supplies for the United Nations, the committee urged that steps be taken to develop known foreign fields, particularly those in the Persian Gulf.

Harking back to the Cole report of Dec. 31, 1942, the committee declared that since then the need of a price stimulus to bring in new supplies has become more obvious and pronounced.

"A careful review of the present situation", the committee found, "indicates that under present practices and rate of discovery within one year we will reach the decline in the productive capacity of American oil fields."

The committee continued:

"Current demands have exceeded productive capacity to such an extent that above ground stocks have been depleted by 55,000,000 bbls. in the last 12 months. Forecasts, probably optimistic, indicate that production from our presently developed sources will reach a maximum daily production of 4,420,000 bbls. for 1943; 4,212,000 bbls. for 1944; and 4,022,000 bbls. for 1945.

Sight 25% Hike in Demand

"Against this background of declining supply and reduced stocks we have a tremendously accelerated demand on our supplies for military purposes. No one can forecast with exactness the quantity of new discoveries which may be obtained or the exact needs of our military establishment. It is probably conservative to say that our increased demand on our oil supplies, due to our military operations and Lend-Lease supplies, will amount to more than 1,000,000 b/d. This would be an increase of 25% above a peacetime peak of consumption.

"We might hopefully conjecture an early termination of the war, but plans with primary regard for military effectiveness must provide for a continuance of the war for at least 2 years. America is even yet in the initial stages of the tremendous war power it will be able to assert in 1944.

"The big demand upon petroleum products is yet to come. Those plans call for a vast increase in our military plans; thousands of combat vehicles; and millions of tons of merchant shipping. The plans look to oil as the motive power for practically every movement of men, materials and equipment for our armed forces."

A cut-back in civilian supply to meet military demands, the committee observed, does not go very far until it begins to break down domestic economy on which the success of the war effort depends.

"Men, experienced in the oil industry and reliable," the committee stated, "have informed our committee that the discovery costs per barrel have in the last 4 years increased from 15 to 50c. Statistics indicate that nearly 5 times as many exploratory wells are required to locate the same amount of oil as 6 years ago.

"In the face of this situation, we have a definite trend under present war conditions and industry regulation by the government, toward the elimination of the independent producer. He belongs to that branch of the industry which has been most responsible for the major portion of the past discoveries. The pinch of inadequate prices for crude hits him first and hardest."

Find Wells Abandoned

The committee found that wells are being abandoned because of disparity between crude ceiling prices and increased operating costs, and the aggregate production of such wells is enough to be important.

New discoveries, the committee said, have been declining since 1939. We use 1,400,000,000 bbls. of oil a year, the committee pointed out, yet discoveries since 1939 have been at the rate of only about half the consumption rate.

"Much of the crude now being furnished for our war and civilian needs," the committee declared, "is supplied below the cost of production. Practically all the crude supply of the Nation is being furnished below its replacement value from new sources.

"We face a period of declining supplies, increased demand, increased costs and prices."

Point to 'Uneven' Prices

The committee called attention to the uneven planes of prices, pointing out that in 1926 crude oil sold for $1.80 a bbl., where its price now is about $1.18. Taking that year as the standard represented by 100 by comparison the committee found these relative prices today: Crude oil, 61.2; cost of living, 97.5; farm products, 117; bituminous coal, 120.4; industrial labor per hour, 170.4.

The index price of crude as compared with 1926 has decreased 38.8, the cost of living 2.5. There has been an increase in farm products of 17, in bituminous coal of 20.4, and in labor of 70.4. Costs of materials, labor and discovery have greatly increased, yet these increases are not reflected in oil ceiling prices.

"We can scarcely hope to make a success of inflationary control," the committee declared, "if we arbitrarily base it on uneven planes of prices frozen without regard to just price relationships."

The committee said OPA seems "to cling to a policy of securing a supply of oil by price ceilings below fair costs even when applied to the production of an essential war material. When the government, more or less arbitrarily, assumes responsibility for limiting the producers' price, a fair or reasonable price should be allowed as a matter of course."

As a means of conserving reserve supplies in this country, the committee recommended development of foreign oil fields.

Want Persian Gulf Developed

"A very high percentage of all the petroleum products now being used by the United Nations comes from the oil fields of America," the committee declared. "The long distance transportation to the battle lines is slow, expensive, takes a high toll of critical materials and proportionately subjects transportation to the hazards of war.

"There are great supplies of oil in the Persian Gulf area. More substantial war supplies should now come from that source. The production in that area could be greatly increased by more wells, establishment of refineries and pipelines to connect the supply with water transportation at the Mediterranean. That and other courses of foreign oil could increase the war supply of petroleum if the war long continues.

"In the judgment of this committee, the conservation of our own resources, as well as a more assured supply for military and civilian purposes, require that every practicable effort be made to increase these foreign supplies for war purposes. Such increases would decrease the demands upon our oil reserves, shorten our ship lines, reduce the war transportation hazards, increase the amount available for civilian use and prolong the available supply of oil for America. Unquestionably, our military authorities are not unconscious of this situation.

This committee believes that they and other agencies of our government should within the limits of their authority, make every practicable effort to develop these known oil fields "for the aid of the war cause of the United Nations and to the lasting benefit of our country."

Measured by the life of the nation, the com-

Whom do we serve?

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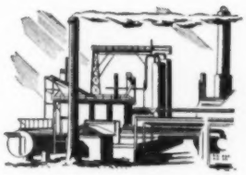
Badger builds plants for the Petro-Chemical Industry



Among the modern base chemicals being produced from natural and petroleum refinery gases, Badger engineering and construction cover such products as:

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mittee said, our domestic supply of oil is brief, and beyond that America must eventually share in the supplies of other lands. Beyond that, the committee said, perhaps we must resort to substitute fuels such as can be gained from oil shale, coal, and alcohol.

Buttram Makes Appeal For Higher Price; Sees Crude Shortage

NPN News Bureau

TULSA—Strong argument for an increase in the price of crude oil is contained in a statement just issued by Frank Buttram, president of the Independent Petroleum Assn. of America.

Speaking in behalf of the 6000 independent oil producers in the U. S., Mr. Buttram makes his appeal direct to the nation.

"The situation with reference to the adequacy of our ability to produce crude petroleum at a rate that will meet military and essential civilian demand is so serious as to deserve not only the careful consideration of every government agency concerned but also careful consideration of every citizen of our nation," he declares.

"In the report of the committee on cost and price adjustment of the Petroleum Industry War Council, Feb. 3, it was estimated that the total maximum efficient productive capacity from known fields in the U. S. by the end of 1943 would be equivalent only to the minimum essential demands and that if ability to produce was not increased after the close of 1943 there would be a shortage of crude oil.

Sees Serious Situation in '44

"Subsequent developments indicate that the situation with reference to our ability to produce under efficient rates of production has grown worse and that by the first quarter of 1944 the situation will become serious.

"No accurate figures are available as to military demand but we do know that as the war progresses and our forces become more actively engaged in combat and are spread over practically the entire world there will be enormous increases in military demand for petroleum products."

Again quoting the cost and price adjustment committee's report Mr. Buttram points out that District 3's estimated maximum production requirement during 1944 will be 2,435,000 b/d and that the district now is producing only 2,000,000 b/d.

"To reach the estimate in the report referred to there would have to be an increase in production of 435,000 b/d and that", Mr. Buttram says, "has been estimated to be the maximum that can be reached.

Must Hike District 3 Output

"On account of revisions in figures in other districts which result in decreases in estimates of maximum efficient productive rates, it will now be necessary, in order to meet total essential demand, to increase the production in District 3 495,000 b/d.

"Even recognizing the fact that the productive rate will be greater during the first quarter than the average for the year it can readily be seen that unless a substantial quantity of new oil is discovered there will be a shortage of productive capacity by the first quarter of 1944 and that it will be impossible, producing all the oil wells in the country at their maximum efficient productive capacity, to produce sufficient oil to meet minimum essential demand."

Hits OPA's Price Policy

Mr. Buttram points out that one of the most important factors in ensuring an adequate petroleum supply is that which involves providing new sources. The price of crude oil has been kept at a depressed level for years so that the oil producer is unable to secure the funds to expand exploratory effort to the necessary point and to maintain his existing properties in efficient operating condition.

"The only agency", he says, "that has to date been unwilling to recognize that an increase in the price of crude is essential to the war effort, is the Office of Price Administration which has refused to approve the recommendation of the Petroleum Administrator for War, of an increase of an average of 35c per bbl. and has suggested in lieu thereof some theoretical form of subsidy which is entirely foreign to fundamental American principles and which will tend toward the development of a national socialistic state which type of government our country is opposing in fighting the war in which it is now engaged."

10,000 Wildcats—And Then Some

Lovejoy Answers OPA Brown's Statement that Drilling is 'Sufficient'; Holds Rate Must Rise More as Productivity Per Discovery Goes Down

A serious threat to the country's oil supply, both civilian and military, is shown in a compilation made by John M. Lovejoy, president of the Seaboard Oil Co. and member of the PIWC, which reveals a declining rate of discovery per wildcat well. It shows that, in the existing situation, the greater the wildcat drilling the less the oil discovered, leading to the conclusion that still more drilling will be required to find oil in any great quantities. More than 10,000 wildcats are needed in 1943, Mr. Lovejoy says.

His statement is one of many being issued by Chairman J. D. Gill of the PIWC committee on cost and price adjustment, in reply to statements made by Price Administrator Prentiss Brown in rejecting the oil industry's plea, supported by PAW Ickes, for a 35c advance in the price of crude oil. Mr. Brown pointed to the increased number of wildcat wells drilled in the last 6 years as a demonstration that there is "sufficient" drilling. Mr. Lovejoy stresses the poor results of such drilling in urging price conditions that will bring about twice as much wildcatting at least.

Mr. Lovejoy's statement, as issued by Chairman Gill of the PIWC committee, said:

"Price Administrator Brown's statement carries the implication that the number of exploratory wells drilled in 1942 was sufficient. The facts seem to prove conclusively that exploration in 1942 was entirely inadequate and that the rate of drilling exploratory wells must be greatly increased if military and essential civilian demands are to be met.

'More Chances, More Hits'

"It is true that the number of exploratory wells drilled is not necessarily an exact measure of the number of fields that may be discovered or of the amount of reserves thus made available, but it is the best yardstick we have. We are dealing here with laws of chance, the first rule of which is that the greater number of chances, the greater number of hits.

"The following table, compiled by E. L. DeGolyer, assistant deputy petroleum administrator, in April, 1943, summarizes results of wildcat drilling from 1937 through 1942 and is highly significant:

Year	Tot. Wildcat Wells	Successful Wildcats	New Fields Discovered	Total New Reserves Discovered[1] Million Bbls.	Discovered per Field Million Bbls.
1937	2,224	222	148	2,119	14.3
1938	2,638	294	166	1,894	11.4
1939	2,589	224	170	943	5.6
1940	3,038	302	217	945	4.3
1941	3,264	503	209	361	1.7
1942	3,045	493	261	317	1.2

[1]Revisions, extensions and new horizons are credited back to year of field discovery

1942's New Fields Small

"Although this table shows that the number of new fields discovered has increased with a *high* record in 1942, the new fields of that year are small, and account for a total of only 317 million barrels of new reserves, which is a new *low* record for many years. The trend of exploration is definitely established over a seven or eight year period to be less new reserves per field discovered and per exploratory wells drilled.

"The greater number of fields discovered is much more than offset by the decline in average size per field from 14.3 million barrels in 1937 to 1.2 million barrels in 1942. During this same period the amount of oil discovered per wildcat well declined from 950,000 barrels to 130,000 barrels, or less than one-seventh as much.

"The industry's ability to produce is directly proportional to its proven and developed reserves, which can be maintained only by constant additions through discovery. Over a period of years extensions and additions to previously discovered fields have held our total estimated reserves at a figure commensurate with withdrawals, but a large part of these additions merely represents new estimates of old fields.

"The vital need is for new sources of supply. DeGolyer's table shows new discoveries by years with revisions, extensions and new hori-

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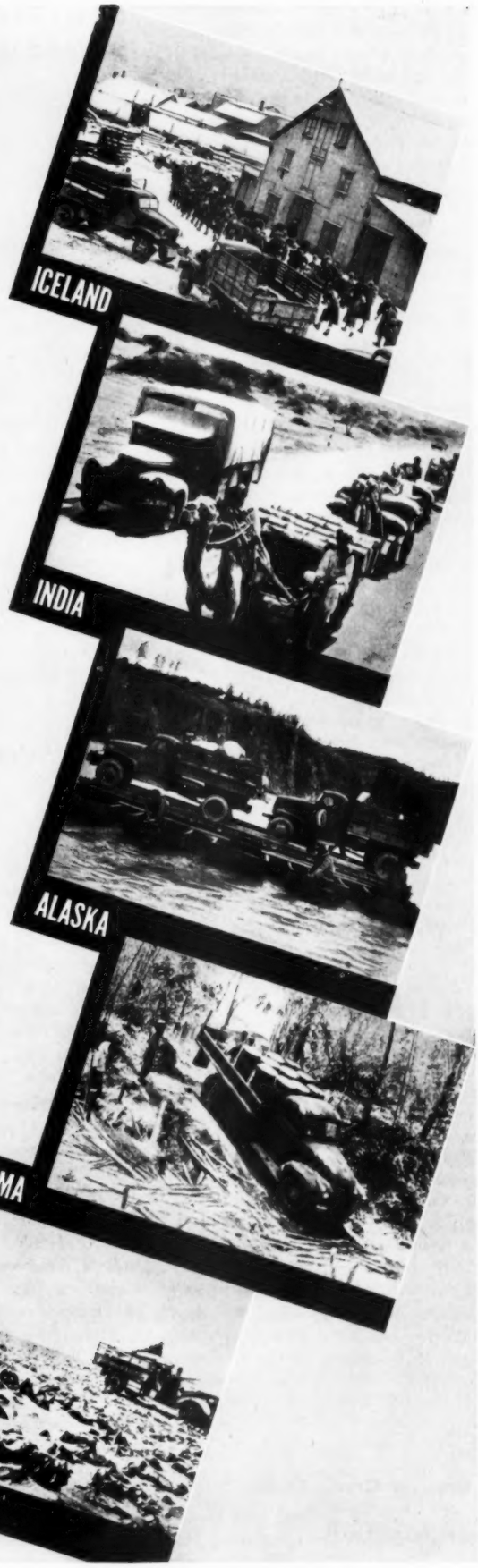

zons credited back to the year of field discovery. Although information obtainable through more complete development may result in upward revisions of the figures given for 1941 and 1942 field discoveries, the downward trend is so clearly established it cannot be questioned. New discoveries far greater than in previous years are essential to the welfare of the nation.

Surplus in Texas

"Surplus productive capacity of the country is from limited sections in the south, southwest and west Texas areas and is estimated to be about 500,000 barrels per day, representing about 12% in terms of current production. Estimates of demand, together with decline of other areas, indicate that by the end of 1944 the nation will be producing to full capacity consistent with sound production practice.

"There is only one way to correct this situation. Drill more wildcat wells, which on the law of averages should result in greater new discoveries. The number drilled in 1942 was far too few. The number actually being drilled and even the number recommended by PAW for 1943 is far too low. What is really needed is discovery of a few real big fields, but with present finding technique the chances of this are not good.

"If new discoveries are to keep pace with withdrawals, which is a reasonable desideratum, and assuming a continuation of the percentages of hits and average size of new fields as shown for the years 1941 and 1942 in the DeGolyer table, more than 10,000 wildcat wells should be drilled in 1943!

"It appears, therefore, that any statement carrying the implication that currently equaling 1942 exploratory activity is sufficient, is misleading and will not bear even casual analysis."

Encourages Search for Oil In California Tidelands

LOS ANGELES—The California State Land Commission has taken action to boost the production of oil needed in the war effort. An oil and gas survey of tidelands lying along the entire coast of California has been ordered by the commission.

Dr. E. K. Soper, commission geologist, particularly emphasized that the state should look for oil in the tidelands in the vicinity of Venice, Redondo Beach, the Santa Barbara mesa and Summerland, as well as at the mouth of the Santa Clara River in Ventura county.

The commission has voted to call for bids on slant wells to be drilled in the tidelands near Newport Beach, Rincon field in Ventura county and Elwood field in Santa Barbara county.

Reports Drop in Crude Stocks

NPN News Bureau

WASHINGTON—Stocks of domestic and foreign crude totaled 242,657,000 bbls. on June 26 compared with 243,516,000 bbls. the preceding week, Bureau of Mines reported July 2.

New Order Encourages Secondary Recovery

NPN News Bureau

WASHINGTON — To facilitate the program for secondary recovery of crude oil throughout the country, PAW on July 2 issued Supplementary Order No. 6 to PAO No. 11 which will permit petroleum operators to acquire and use materials in secondary recovery operations without regard to the restrictions otherwise imposed by PAO 11.

Commenting on the amended order, which supersedes a temporary order which expired June 30, Deputy PAW Davies stressed the importance of secondary recovery operations as a source of an additional supply of crude to meet constantly expanding requirements.

Davies Urges Extra Effort

"Secondary recovery," he said, "means getting more of the oil which we know is in the ground. It is especially important, in view of the disappointing new discovery records of recent years, that we exert our efforts and ingenuity to increase secondary recovery production at this time. The Petroleum Administration hopes that operators will take early advantage of the authorization included in this supplementary order to inaugurate an unprecedented number of secondary recovery projects."

Secondary recovery operations are, of course, considerably more costly than primary production operations, Mr. Davies pointed out, and it is realized, he said, that the existing crude oil price level is not favorable toward the initiation or conduct of these operations.

This is one of the important reasons which led PAW Ickes to recommend a general upward adjustment in the crude oil price ceiling, he added.

Define 'Secondary Recovery'

Under the terms of the order, secondary recovery operations involve the injection of air, gas, or water into the producing formation for the purpose of increasing or sustaining production from it, and include the drilling of production and injection wells. Pressure maintenance, high pressure cycling, and salt water disposal are specifically excluded from the definition of secondary recovery.

The authorizations under the amended order extend only to an operator who conducts the specific injection program, or who contributes money, property, or service as a participant in a specific secondary recovery program. The authorization for drilling of production wells extends only to such operations conducted within a radius of 2000 ft. of any air or gas injection well or within a radius of 1000 ft. of any water injection well.

Etex Water-Oil Ratio Held 'Invalid'; File Appeal

Special to NPN

AUSTIN—The Railroad Commission's 5-to-1 water-oil ratio is operating under doubtful legality in the sprawling East Texas field after the order was declared invalid in an Austin district court.

Judge J. D. Moore, ruling on an injunction case brought by the Konowa Operating Co. and other marginal well owners, held that the commission's order was in violation of the 47th Legislature's marginal well law passed in 1941, and enjoined the commission from enforcing it.

The commission, however, served notice that it will appeal the lower court decision to the Third Court of Civil Appeals, which automatically stays the injunction and allowed the ratio to become effective July 1.

Judge Moore ruled that the original 10-to-1 ratio order filed last November was unlawful, and in doing so also knocked out the 5-to-1 order announced late last month following the statewide oil proration hearing in Austin.

The 5-to-1 ratio order was put out after the commission followed the PAW request and increased the production days for the big field from 20 to 23 in July.

Operators told the commission that something must be done about salt water production in the field if it is to meet the increased demand for oil without damage, and the 5-to-1 order was the way the commission moved to meet the situation. Most marginal wells are operating on a 20 b/d allowable, and the reduced water-oil ratio meant that when they had produced 100 bbls. of water they had to close down.

Konowa and the other East Texas operators complained in their attack on the order that it resulted in confiscation.

Judge Moore held that the ratio is invalid "in that said order attempts to, and, if enforced, does restrict the production of marginal wells . . . and that such restriction is prohibited by the marginal well law . . ."

Judge Moore in his opinion said that the marginal well law expressly prohibits orders of the character of the water-oil ratio.

Sohio Buys Appleman Properties

NPN News Bureau

CLEVELAND—Standard Oil Co. of Ohio July 6 confirmed purchase of the oil properties of Nate Appleman, Wichita, (Kans.) oil operator, in western Kansas. Price was reported to be in the neighborhood of $2,600,000.

The properties, lying in Russell, Rice, Ellsworth, Ellis, Graham, McPherson and Barton counties, have a daily gross production of 4600 bbls. and a net production of 2400 bbls.

Mr. Appleman said he retains production in Greenwood county (Kans.) and in northern Oklahoma.

Union Oil Properties Sold

Special to NPN

HOUSTON—The Barnsdall Oil Co. has purchased the Keeran field, Victoria county, properties of the Union Oil Co. of California. Amount of the transaction was not announced.

Nine producing wells, including 7 oilers and 2 gas wells, 4820 acres of undeveloped leases, all on the Keeran ranch in Victoria county, were involved in the deal.

It's no good if he doesn't know how to use it!

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Oil TRANSPORTATION

Rails Top Million Barrel Haul

Shipments to East in Week Ended June 26 Total 1,060,744 Barrels a Day, Breaking All Records. Deputy PAW Davies Lauds High Movement

NPN News Bureau

WASHINGTON—Rail hauls of crude and products to the East Coast reached a total of 1,060,744 barrels per day for the week ended June 26—topping by 90,209 bbls. the daily movement for the previous week and exceeding the previous all-time record by 63,179 b/d, PAW Ickes announced July 3.

Explaining revision of the 999,684 b/d figure announced June 30, Mr. Ickes said it was based on additional data made available the morning of July 3. It included substantial shipments by box car on which no information was available when the usual weekly audit of oil transportation records was closed.

Hailing the new record, PAW Deputy Davies said:

"The significance of this tremendous oil movement must be apparent to everyone. The route to Berlin is a river of oil. The oil company shippers and the railroads are doing a great job to keep that river at flood tide. More oil for the East means more oil for war and every drop of the precious stuff that we can lay down at East Coast docks for the dangerous overseas haul speeds the time when victory, and victory alone, will permit us to think again in terms of more gasoline for non-military use."

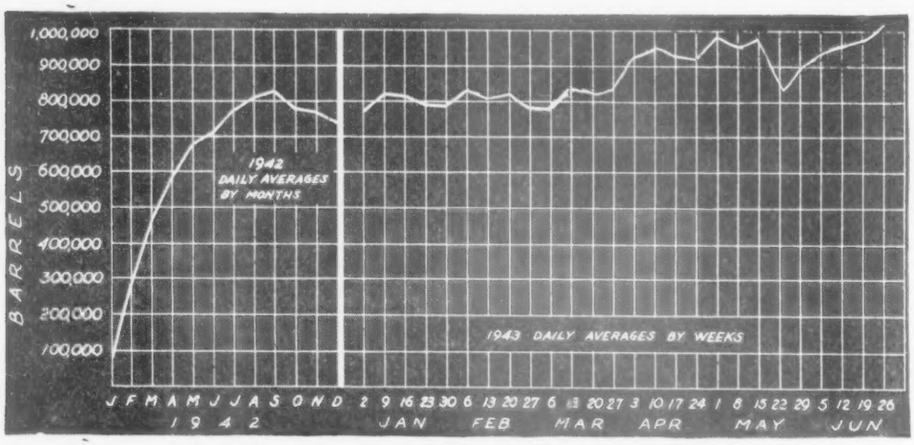
Mr. Davies reported there are now 73,862 tank cars hauling oil into District 1. In addition, there are 6,000 used in distribution within the district. This makes a total of over 80,000 tank cars in service for the East Coast out of a total of 107,000 in petroleum service throughout the U. S. This means, Mr. Davies said, that 75% of all those available in the country are serving the Atlantic Seaboard and in point of capacity the percentage is nearly 80% since those of larger capacity have been placed on the East Coast run.

Of the 27,000 tank cars in service outside of District 1, he added, only approximately 2500 are hauling gasoline, and these are on military, agricultural, and industrial assignments as imperative as are the assignments on the Eastern Seaboard.

Regarding the "big inch", Mr. Davies said the line will be completed to Philadelphia and New York in about 2 weeks. Oil will be flowing through from Texas to the Atlantic Seaboard by Aug. 1, though the full capacity of 300,000 b/d will not be reached until some weeks later.

A total of 32,218 tank cars were loaded in the record-breaking rail movement to the East by 62 participating oil companies as follows:

Company	Cars	Company	Cars	Company	Cars
Allied	33	Globe	88	Royal Petroleum	248
American Bitumuls	30	Gulf	2891	Shell	1182
Amsco	461	Hartol	169	Sinclair	2293
Arkansas Fuel Oil	70	Hess, Inc.	6	Socony-Vacuum	3139
Ashland Refining	70	Home Oil	13	Southland	9
Asiatic Petroleum	17	Industrial Oil & Gas	18	S.O. California	19
Atlantic Refining	3377	James River	8	S. O. Kentucky	94
Bell Oil & Gas	1	Jenny Mnfg. Co.	22	S.O. New Jersey	7202
James B. Berry Sons	9	Libby Oil	4	S.O. Ohio	47
Canfield	1	National Refining	3	States	1
Cantelou	17	Old Dutch	1	Sterling Stations	12
Chalmette	39	Pacific	13	Sun	2751
Cities Service	1150	Pan American	2145	Talco	45
Cosden Petroleum	156	Petroleum Corp.	107	Taylor Refining	112
Continental	217	Petrolcum Heat & Power	19	Texaco	2182
Crown Central	26	Phillips	12	Tide Water	1049
Crown Petroleum	15	Pioneer	1	Tiona Petroleum	12
Daugherty	15	Premier	27	Triangle Refining	38
Deblois	3	Pure	36	United Refining	5
Elk Refining	40	Republic	313	Wood River	64
Freedom Oil	2	Roosevelt Oil	8	"Miscellaneous"	59



Discontinue Emergency Truck Movement To Washington, D. C.

NPN News Bureau

WASHINGTON — The emergency tank truck movement of gasoline from Plantation Pipeline's terminal at Greensboro, N. C., to the Washington-Alexandria area has been stopped, after nearly 8,000,000 gal. were transported, ODT reported July 3.

ODT officials described the operation, the first of its kind ever attempted, as "very successful", and disclosed that other fleets of large tank transports with temporary idle capacity were available for any similar movements which might become necessary to relieve local shortages.

Arrangements for the emergency operation required the combined action of the ODT, the Interstate Commerce Commission, PAW, Defense Supplies Corp., RFC subsidiary, and the state governments of Virginia and North Carolina.

Despite the unprecedented nature of the movement and the number of agencies involved, 100 truckloads—nearly half a million gallons—were delivered to the critical area within 36 hours after final authority had been granted the carriers on May 28.

200 Trucks Participated

Altogether some 65 operators and 200 trucks participated in the movement, with as many as 140 trucks on the run at one time. The operators were from North and South Carolina, Virginia, Pennsylvania, and the District of Columbia.

ODT officials praised the work of the War Emergency Cooperative Assn., which acted as the carrier in leasing the trucks that participated. The association is a South Carolina carrier group organized by the ODT in June, 1942, in anticipation of emergencies which would require movements by carriers associated for concerted action.

From May 29, when the movement began, to June 30, when it ended, 1900 truckloads were delivered in Washington and Alexandria.

Sinclair Begins Construction Of Chicago-Toledo Pipeline

NPN News Bureau

WASHINGTON—Construction of Sinclair's 8-in. 240-mile products pipeline from Chicago to Toledo is now in progress, ODT Director Eastman has reported, with practically all rights-of-way already acquired.

Pipe from its system in the Mid-West and Southwest is being reclaimed for use in the line. The line, which will result in shortening turnaround time for tank cars as well as relieving lake traffic and shortening the haul by water, will cost about $6,000,000 and have a capacity of 30,000 b/d when completed.

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CLOSURES

Trucking Tape Cut

Highway Users Summarize June Sweep of Liberalized Legislation in States; Length and Axle-Weight Formulas Are Revised and Full Reciprocity Affirmed

NPN News Bureau

WASHINGTON — Recent legislative action by states liberalizing laws governing sizes and weights of motor vehicles and strengthening reciprocity in interstate motor transport is summarized in a June 23 report of the National Highway Users Conference.

The reforms were largely inspired at a meeting of the Federal-State Conference here in May, according to the conference, which lists remedial legislation up to June 18 as follows:

Increased gross weight of motor vehicles: Alabama, South Dakota, Kentucky, Missouri and Nebraska.

Increased length for tractor-semi-trailers: South Dakota and Minnesota.

Increased length of single unit: Delaware, Alabama, Missouri, and Minnesota.

Increased axle weight: Arkansas, Missouri, Nebraska and Pennsylvania.

Increased weight for tractor-semi-trailers: Delaware and Pennsylvania.

Provided that a tractor and semi-trailer shall be regarded as 1 vehicle for the purpose of determining length: Minnesota.

Increased weight for 2 and 3 axle vehicles: Pennsylvania.

Provided a gross weight according to the formula 700 L plus 40: Minnesota and Missouri.

Provided formula 750 L plus 40 for determining gross weight: New Mexico.

A bill is pending in Wisconsin to increase the length of tractor-semi-trailers and another in Illinois to increase axle and gross weights.

ODT Proposal Accepted

A bill which would empower state governors to suspend laws, including size and weight laws that might constitute a trade barrier or interfere with the war effort, was drafted by ODT in cooperation with the Council of State Governments. The measure was submitted to the legislature in session this year and adopted with modifications in California, Delaware, Iowa, Minnesota, New Hampshire, North Carolina, North Dakota, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington. South Carolina directed the highway department to suspend inspection of all motor vehicles for the duration.

Efforts toward improvement of reciprocal relations between the states include the following:

Illinois: Created a state legislative committee to investigate relationship between Illinois laws and those of other states with respect to reciprocity agreements and to make recommendations to the legislature in session.

Minnesota: Now provides for reciprocity on special fees collected from non-resident interstate for-hire carriers and extends full reciprocity on license fees to transporters of petroleum products in bulk, non-resident operators of trucks not for hire who are registered or licensed to do business in Minnesota and for-hire transporters of feeder livestock up to a distance of 150 miles into Minnesota.

New Hampshire: Now provides full reciprocity for all non-resident vehicles.

South Dakota: Declared the policy of the state to grant full reciprocity on motor vehicle fees and taxes to all vehicles in interstate commerce and authorized the highway commission to make reciprocity agreements.

Tennessee: Authorized commissioner of finance and taxation and the chairman of the railroad and public utility commission to enter into reciprocal agreements with other states under which non-resident motor vehicles may be operated in Tennessee without Tennessee licenses.

Utah: Provides reciprocity for non-resident vehicles for-hire.

Wisconsin: Provides that for the duration the motor vehicle commissioner shall have authority to enter into reciprocal agreements with other states.

Wyoming: Provides reciprocity to non-resident truck operators operating a distance of 75 miles into the state.

Production Schedule For New Trucks To be Reshuffled

NPN News Bureau

WASHINGTON—A recasting of the present schedule for a production of 7500 heavy duty trucks for the second half of 1943 is expected shortly so that types of equipment made will conform with industry needs, although the number to be made will remain unchanged. This was one result of 4 days of conferences between WPB and ODT officials, truck manufacturers and trailer makers, and American Trucking Assn.'s war planning committee, A.T.A. reports.

Other developments, A.T.A. said, were:

WPB has before it a request to abandon a plan requiring trailer manufacturers to produce only a so-called prototype vehicle in which the chassis must be fitted with a body instead of the present-day vehicle in which chassis parts are integral with the vehicle.

ODT has been advised of minimum need of 128,167 replacement and additional equipment in the for-hire industry for the period through Dec. 31, 1944, including 7500 heavy duty trucks and 9200 trailers already ordered.

A request has been made to WPB that it set up a trucking industry advisory committee to keep it posted on future developments and needs.

Ask Immediate Release

ODT is considering a request that when new vehicles are made they be released at once for use rather than placed in a reserve pool as has been done heretofore.

WPB has been given a list of critically needed automotive parts for repairs and replacements.

A.T.A. feels the stage has been set for a measure of relief for the trucking industry from pressing burdens of inadequate new equipment and shortage of parts. ODT as claimant agency on WPB, it was pointed out, must take many or most of the implementing steps, but since both agencies were kept informed during the entire proceedings it is expected there will be no conflict in views and that ODT will concur in any WPB action under the program. In fact, A.T.A. added, it is understood that WPB voiced no objections to the suggestions made by the war planning committee and let it be known that if ODT so desired, the relief steps at least on revision of the heavy duty truck scheduling calling for 7500 vehicles could be taken.

The committee, A.T.A. said, found early in its sessions that the 7500 heavy duty trucks planned for the last 6 months of 1943 had been scheduled to comprise 4250 with 400 to 450 cu. in. displacement engines, and 1500 in a class of a minimum of 350 cu. in. with 1750 left as the largest or special equipment sizes and classes.

The evident unbalance in favor of the larger types was countered with presentation of a revised schedule to WPB on which ODT is expected to concur.

The 7500 figure would remain unchanged but types would be revised so that the total when manufactured will break down into 1400 vehicles with 250 to 300 cu. in. engine displacements, 2950 of 300 to 400 cu. in., and 1400 of 400 to 450 cu. in., A.T.A. said.

The extra heavy and special equipment classification, including 1750 vehicles, remains unchanged. Included in this category are 100 vehicles of 25,000 to 32,000 gross vehicle weight, 1250 in the 50,000 lb. class, and 400 in the 40,000 to 75,000 lb. These "extra heavy duties", A.T.A. added, include not only trucks but trailers and trailer trains.

Need More Equipment

The operators, it was reported, also informed ODT that if the 10-15% heavier war load anticipated by the transportation agency for the second half of this year and later is to be moved, it will be necessary to permit manufacture of 128,711 pieces of equipment for the for-hire motor carrier industry between now and the end of 1944, including the 7500 heavy duties for which the revised schedule calls.

In its formal presentation to ODT's Motor Transport Director Rogers on new equipment needs from now through 1944, the A.T.A. war planning committee said:

"In developing these figures, the committee feels that it is the very rock bottom in the way of new equipment. This number of units is absolutely essential for the for-hire branch of the industry to carry on with the added burdens placed upon it. We hope that every effort will be made by ODT to see that these vehicles are scheduled for production and made available during the period covered."

WPB Authorizes Manufacture Of 7500 Heavy Trucks

NPN News Bureau

WASHINGTON—Production of 7500 heavy highway trucks and 241 off-the-highway automotive vehicles has been authorized by WPB for the third and fourth quarters, it was announced July 2.

The trucks are classified by gross vehicle weight and drive type classifications. Num-

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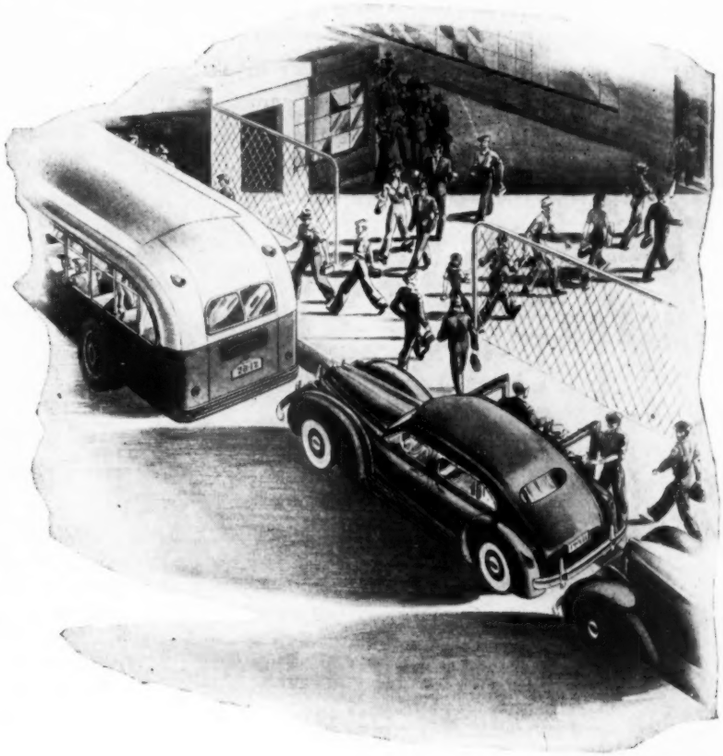

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ber of on-highway trucks authorized in each are as follows:

Trucks	Weight	Drive
1,500	18,000 lbs. to 22,000 lbs.	4x2
4,250	24,000 lbs. to 30,000 lbs.	4x2
1,100	27,000 lbs. to 36,000 lbs.	4x2
150	27,000 lbs. to 36,000 lbs.	4x2 Diesel
400	37,000 lbs. to 43,000 lbs.	6x4
100	25,000 lbs. to 32,000 lbs.	Snow Plows

The 14 companies which will produce the heavy highway trucks are:

Autocar Co., Ardmore, Pa.; Brockway Motor Truck Co., Cortland, N. Y.; The Corbitt Co., Henderson, N. C.; Federal Motor Truck Co., Detroit.; General Motors Truck & Coach, Pontiac, Mich.; Four Wheel Drive Auto Co., Clintonville, Wisc.; International Harvester Co., Chicago; Kenworth Motor Truck Co., Seattle; Peterbilt Motors Co., Oakland, Calif.; Mack Mfg. Co., New York; Reo Motors Co., Lansing; Sterling Motor Truck Co., Milwaukee; Walter Motor Truck Co., Long Island City, N. Y.; White Motor Co., Cleveland.

The 241 off-the-highway vehicles include trucks, truck tractors and trailers. They will be manufactured by Dart Truck Co., Kansas City, Mo.; Euclid Road Machinery Co., Cleveland; Kenworth Motor Truck Co., Seattle; Mack Mfg. Co., New York City; and Peterbilt Motors Co., Oakland.

WPB Releases 1818 Vehicles

NPN News Bureau

WASHINGTON—A total of 1818 vehicles was released under the truck rationing program during week ended June 26, WPB reported July 2, with civilian users and holders of government exemption permits receiving 394 light, 994 medium, and 195 heavy trucks; 225 trailers; and 10 attachment third axles.

Since inception of the program on March 9, 1942, a total of 142,394 vehicles of all types has been released. This includes 33,454 light, 78,896 medium, and 17,329 heavy trucks; 11,265 trailers; and 1450 attachment third axles.

Summarizes Age Limits On Employment In Transportation

NPN News Bureau

WASHINGTON—A summary of state and federal laws and regulations affecting the employment of young persons has been made available to the transportation industries, Otto S. Beyer, director of ODT's transport personnel division, reported July 2.

In addition to setting forth state and federal regulations as they apply to minors in transportation industries and related occupations, the summary includes a state-by-state digest of minimum ages for employment in occupations considered hazardous or possibly detrimental to young people. Also listed are maximum hours of work, night work prohibitions, required meal periods and minimum age requirements for motor vehicle operators.

Relax Few Rules on Minors

The study points out that few labor standards for minors under 18 years of age have been relaxed during the present war. While broad emergency powers that might be interpreted to extend to labor legislation have been enacted by the legislatures of Connecticut Massachusetts and North Carolina, up to the present time no orders have been issued under these acts permitting relaxation of standards affecting minor workers.

Probe for Crude with Horizontal Wells

Venango Development Corp., Seeking Last Drop Under 400-Acre Tract in Pennsylvania, Drills Horizontal Wells from Bottom of Oil 'Mine'

By Earl Lamm

PERCOLATE that last drop of Pennsylvania grade crude from the sand!

That apparently is the sentiment of 11 oil producing and refining companies and 5 individuals who over a year ago formed the Venango Development Corp.—a stock company—at Franklin, Pa., and started mining for oil, using the Leo Ranney patented method of horizontal drilling of wells, fan-like from the bottom of a mine-like shaft put down to the shallow oil sand itself.

The oil mine is located near the center of 400 acres of land owned by D. W. Grant and his nephew, Dohrman S. Grant, of Franklin, in Sugarcreek township, Venango county, about 2 miles north of town. More specifically, it is spotted in a small hollow in the green western Pennsylvania hills near the head of Snyder Run, a brook flowing into Two Mile Run creek which hooks up with the Allegheny River a short distance away.

At one time, the acreage was owned by South Penn Oil Co. On it are 91 old stripper wells dating back to 1875-76 when the field first came in. These wells are still being operated, making about one-tenth of a barrel per day each.

Investors in Project

Samuel Messer, president of Quaker State Oil Refining Corp., Oil City, Pa., is president of Venango Development Corp. Vice-president is F. D. Dorn, who heads Forest Oil Co., Bradford. Others interested are South Penn Oil Co., Pittsburgh: Pennzoil Co., Oil City; Freedom Oil Co., Freedom, Pa.; Pennsylvania Refining Co., Butler, Pa.; Canfield Oil Co., Cleveland, Ohio; Franklin Creek Refining Corp., Franklin; Kendall Refining Co., Bradford; Alliance Oil Corp., New York; Earl Emery, Bradford; John P. Herrick, Olean, N. Y.; C. M. Davison, New York; N. V. V. Franchot, trustee, Olean, N. Y.; United Refining Co., Warren, Pa.; Grant and Grant; and Page Oil Co., Olean, N. Y.

Mining for oil is not entirely new. The idea came from Germany and France a good many years ago. But the Venango project includes many ideas being tried out for the first time. The procedure was to first sink a shaft 8 ft. in diameter, 430 ft. deep, then hollow out a working chamber 27 ft. in diameter in the hard Venango First sand. Both the shaft and chamber were then lined with 12 in. of concrete, which keeps the walls and bottom dry.

For some time, the workmen rode the bucket up and down. Now, an elevator cage has been rigged up for greater safety and convenience, although visitors are not allowed to enter. Also, the operators are being cautious about publicity and over-optimism, declaring the project is "just another gamble in the oil business when oil is so badly needed for the war effort."

Equipment Used

In the work chamber the operators have rigged up an E. J. Longyear rotary drilling machine, tipped on one side and equipped with a few modifications worked out by Mr. Ranney, who is technical adviser on the project, to take care of its unusual position; 2 rod pullers, also designed by Mr. Ranney from previous experience with horizontal drilling; three 20-bbl. tanks and the usual wrenches and other necessary tools.

Ventilation is by down draft in the shaft, sucked out through a 15-in. pipe bedded in the concrete wall. Pipes for gas, oil, water and wires are also enclosed in the concrete lining.

Bottom of the work chamber, 430 ft. down, is near the bottom of the Venango First sand, described as pebbly in spots or irregular and from 20 to 50 ft. thick in the Franklin area. Production is premium, heavy-grade crude oil with exceptionally high lubricating qualities, much in demand in mechanized warfare. It has low gasoline content compared to the Bradford-Allegheny fields.

Five cores have been taken of the sand, one at the mine shaft and one at each corner of the 400-acre property, but result of the core tests made by the Franklin office of the Bureau of Mines has not been announced. Gravity of the crude, however, ranges 31-32 A.P.I., and was famous in the old days of the Galena Signal Oil Co. Present ceiling price is $2.93 and refiners of the area are prodding OPA to approve a 50c premium. Oil from the mine, when production starts, will be taken by pipeline to refineries interested in the Venango Development Corp. To date, total production has been only 6 or 8 bbls., and this an accumulation of some 3 months.

NPN sent Earl Lamm, Chicago staff writer, to Franklin, Pa., last week to get the story of the most unique drilling operation now under way in the U. S.—the "oil mine" in Venango county. His is the first story in any detail to be published about the work of the Venango Development Corp. and the horizontal wells it is drilling in an effort to drain the last drop of crude from a 400-acre tract in the Franklin First sand.—Ed.

Equipment Hard to Get

Priorities for material and equipment for the job have been approved by PAW and its technicians have visited the mine several times. Nonetheless the necessary machinery has been difficult to obtain—and hold. After locating certain pieces of equipment, the Navy or other military service with higher priority grabbed it. Among the small items difficult to get are even things like heavy rubber gloves for the workmen handling material and equipment.

However, with the rotary drilling machine rigged up, horizontal drilling started on two 5-in. holes diametrically opposite each other in the chamber, near the bottom of the oil sand, but tilted upward slightly for gravity flow of the oil and to overcome dropping of the hole. Drilling two holes at the same time, opposite each other across the circular chamber, will mean a labor saving of approximately 75% Mr. Ranney claims, as each of the horizontal wells will serve as a "rat hole" for the other and save breaking drill rod joints, which are standard "B" rods 10 ft. long.

The two 5-in. holes have been drilled for a distance of 100 ft. each, and 3½ in. casing grouted in. These horizontal wells are being deepened with 3 in. holes, the bottoms, or ends, of which are now 175 ft. from the chamber as this drilling did not get under way until the latter part of June. Drilling is being done through a stuffing box at the chamber as a protection against escaping gas, although the sand here has never been known to have much gas, and the rock pressure is zero, according to Andrew J. Saxe, petroleum engineer for South Penn Oil Co., who described the crude as being absolutely flat—denuded of gas.

Saxe Heads Committee

Mr. Saxe is chairman of the 3-man operating committee for the investors. Other members of the committee are C. N. Pfohl, Kendall Refining Co., and W. M. Shoemaker, Forest Oil Co., both of whom are petroleum engineers.

It is anticipated by the operators that the 2 horizontal test wells will be extended for a total depth of 2500 ft. each.

The holes will then be shot with a full hole charge and a thorough test made of results. That proving satisfactory, it is expected from 6 to 22 additional horizontal wells will be drilled, extending out from the chamber like the spokes of a wagon wheel, and draining the entire 400 acres. Perhaps additional secondary recovery will not be necessary, at least for some time; but it is being discussed by the operators. One idea is that vertical gas or hot air input repressuring wells will be drilled between each of the distant ends of the horizontal wells for an intensified program to literally wring the final drop of valuable fluid from its ancient bed of sand.

Would Work Like Dripulator

Thus, the operation would resemble a gigantic, 400-acre coffee dripulator. Pressure of the hot air input wells would heat the cold, sluggish crude oil, causing it to drip faster into the series of horizontal wells extending through the bottom of the sand from the chamber.

Cost figures of the present project are running slightly higher than the original estimate of $75,000. However, this estimate was necessarily based on limited experience obtained by Mr. Ranney principally in drilling horizontally in an outcropping of First Cow Run sand in Havener Run, Morgan county, near McConnelsville, Ohio, in 1939, where no shaft or working chamber was necessary. The hole was merely drilled back into the side of the mountain. At that time, contractor bids for a turnkey job on an 8-ft. shaft were said to vary from $55 to $75 per linear foot, including concreting.

At the present location near Franklin, cost of putting down the 8-ft. shaft was "slightly more than $75 per linear foot, with no idea of what the cost will be for drilling the horizontal wells," according to Mr. Saxe. Excava-

tion of the 27-ft. circular work chamber, which is 50 ft. high, with a vaulted, dome-like ceiling, cost better than $200 per linear foot or a minimum of $10,000 for the job. This, added to 380 ft. of 8-ft. shaft at $75 per linear foot, or $28,500, makes the total for both jobs $38,500, theoretically, but the actual construction cost of both chamber and shaft was "nearly $50,000", Engineer Saxe said.

Above-Ground Equipment

Equipment above ground consists of a 26-ft. steel derrick; 75 h.p. Lidgerwood hoist to handle the elevator cage loaded with tools, pipe, workmen, etc.; 75 h.p. Worthington air compressor and tank; 3000 ft. of drill rod for 3-in. hole; diamond core bits and other tools valued at about $19,000.

Value of the equipment in the working chamber is also about $19,000. All equipment in the chamber is explosion proof, including a mine telephone costing approximately $360. Electric lights have double bulbs sealed gas tight. All machinery is operated by electricity from above and is enclosed gas proof, the wires being in gas proof conduit. A methane gas detector, such as is used in coal mining, is employed, although the operators report there has been no difficulty with foul air.

Totaling figures—$50,000 for shaft and chamber, $19,000 for tools, machinery and equipment above ground and a like amount for those in the chamber—makes the project to date cost $88,000, or roughly $220 per acre for the 400 acres, with cost of completing the 2 horizontal wells to be added. This, it is anticipated, will bring the total operation to nearly $100,000, according to Mr. Saxe. Capital structure of the Venango Development Corp. is undergoing a change but the details were not revealed. It was stated, however, that drilling of the 6 to 22 additional horizontal wells will cost considerably less than the first 2 now being drilled, since experience is being gained and workmen are being trained.

9 Workmen on Payroll

There are 9 workmen on the payroll now, running one shift of 8 hours daily. Another shift is to be added soon, with a third shift contemplated.

Average cost per foot for drilling of the horizontal well near McConnelsville, Ohio, was $1, according to Mr. Ranney, who said the method was covered in some 20 patents pending. Details of controlling the bits in a horizontal position from a quarter to half mile distance was not disclosed, but was declared to be entirely different from and not related to the Eastman method of directional drilling.

There are no pumps below. One of the 4 x 10 ft. horizontal tanks in the chamber serves as a receiving tank for oil production. The other 2 tanks are for drill water and cuttings. While one of these tanks is in use, the other is blown out by compressed air. The fluid is first lifted to a fourth tank half way up the shaft by 90 lbs. of air pressure and then similarly forced from that level to the surface. Drilling is done with a diamond core bit.

From the viewpoint of results, some interesting estimates have been made, based on comparison of sand footage in vertical holes. Each 100 ft. of horizontal hole is expected to yield 1/16 bbl. of oil per hour, or one to one and a half barrels per day. At that rate, 4800 ft. of open hole (two 2500-ft. horizontal wells less 100 ft. of each cased) should produce 72 b/d of oil. On that basis, 24 horizontal holes under the 400 acres would produce 864 b/d. Estimated cost of pumping is only 1c per bbl. inasmuch as the flow will be by gravity from the nearly horizontal wells into the chamber receiving tank, which gets away from individual pumps, rods, engines, etc., used at vertical wells.

Other advantages of oil mining as set forth by inventor Leo Ranney are that in the Franklin area the Venango First sand is pebbly or porous in spots and therefore not subject to water flood process and air and gas repressuring have been none too successful. Initial cost of those methods is said to be approximately $3000 per acre with operating costs higher than by single mine shaft equipment. Horizontal drilling also means conservation of steel, such as high derricks, casing, tubing, shackle lines and sucker rods; lead lines and pressure lines to individual wells. Mr. Ranney stated drilling and equipping of horizontal wells requires less than 1% of the steel required in drilling and operating vertical wells.

Less Power Used

Also, he asserted, drilling of horizontal wells requires less than 1/10 of the power required for the same length of sand exposed by vertical operation, as the equipment of 2000 vertical wells can be pumped with one pump from a shaft—and no pumps to pull, cups to change, or power to break down. The horizontal wells flow until the sand is exhausted.

Mr. Ranney, inventor of the present method of oil mining and horizontal drilling, is listed in Who's Who in Engineering for his several ideas. He was born at New Hartford, Iowa, in August, 1884, and attended Northwestern University, Evanston, Ill., specializing in geology and chemistry.

His first experiment in mining for oil was in Jack county, Tex., in 1921-25, when he dug a shaft 120 ft. deep, from which horizontal tunnels approximately 3 x 6 ft. were extended. Details were described in NPN Nov. 5, 1924. A major oil company became interested, bought the patents, moved Mr. Ranney to 26 Broadway, New York, and set up the Standard Oil Development Co. with Ranney as president at a "nice" salary. Then the big East Texas field came in with its cheap flush production, and mining for oil was dropped temporarily. Mr. Ranney resigned, recovered his patent rights, and soon started the operation near McConnelsville, Ohio, where he said the backers got into financial difficulties.

Other experiments with oil mining, which did not involve horizontal drilling, include 2 shafts near Pittsburgh. First one was put down in 1859—the year the Drake well came in—but it was only 150 ft. deep and later drilling showed the oil sand was at 200 ft.

The second shaft was 8 x 12 ft., 160 ft. deep, and unlined. It reached the oil sand near Tidioute in Warren county, Pa., in 1865, but an explosion caused by a light tossed into the hole as a gas test before the work crew entered, resulted in death to one of the operators and ended the operation. Still a third shaft was sunk nearby but the flow of gas and heavy cost ended the experiment.

Used for Water Wells

More recently, Mr. Ranney reports marked success in drilling water wells for war projects using his method, except that instead of horizontal drilling, bullet nosed, perforated pipe is pushed into the soft water sand for a distance of 200 ft. to 300 ft. To date some 50 such wells have been put down, the largest one producing 1,500,000 b/d of water, according to Mr. Ranney. It supplies water for a large war plant and is surrounded by 3 circular fences with guards against sabotage.

Oil: Dynamic Force in Building America

The following excerpts from a 4-page booklet just issued by the American Petroleum Industries Committee are quoted here as a tribute to the oil industry and the part it is playing in furthering the progress of America in peace and in the great conflict in which we are now engaged.

The American Way of Life

The petroleum industry has been able to render great service to the American people because of our system based upon individual initiative and free enterprise. It was able to extend its usefulness because of constant improvement of methods and products.

Better Tools for Better Living

Outstanding among the new tools of civilization is petroleum. It assisted our people materially in attaining the highest standards of living ever achieved by any nation in all history. There is hardly an activity in American life to which petroleum does not make a substantial contribution.

Serving the Nation's Oil Needs

The remarkable progress of the petroleum industry in providing transportation at lower costs is an outstanding achievement of the American system of free enterprise. Overcoming many obstacles, the driving force of private initiative facilitated the flow of oil to serve the peace and war needs of the nation.

Triangle of Service

Perhaps no other institution typifies the spirit of service of American private enterprise as does the gasoline station. In a few decades gasoline, lubricants and services were made conveniently available to the public when and where needed. Throughout the nation, on the highways and the byways, gasoline service stations care for the needs of the people in the operation and upkeep of their modern magic carpets . . . .

Station Operator Invents Device To End Gasoline Shortages

At last it has happened!

Not only has the way been found to solve the eastern gasoline shortage as slick as skinning a banana, but in addition it is possible that the rest of the country need have no further worries on this score for the duration and forever thereafter. Other far-reaching consequences may result from this revolutionary upset in the scheme of things. Maybe even the end of the civil war between Roosevelt and Lewis.

And credit for this overnight change will go down in history—not to scientists, not to technologists, not to bright young college boys in government bureaus—but to a "gas station" man by the name of Fred Buck of Northboro, Mass.

Fred is an industrious chap, and generous, too. Instead of waiting for the world to beat a path to his humble station door to see his gas-ration-eliminator invention, he has gone to the trouble and expense of having hand bills struck off giving complete details. He even had a drawing made of his invention (see cut). The illustration is not quite exact, since Fred realized that enemy agents would pounce on his invention quicker than a rat can climb a rafter.

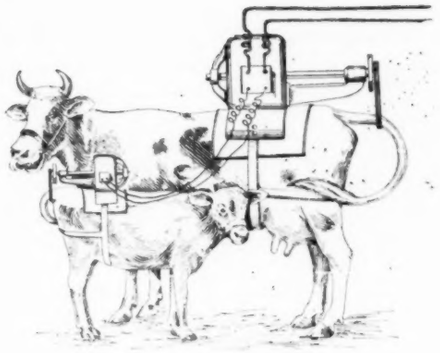
Thought and Investigation Used

After considerable thought and investigation, Fred says in his announcement, he came to the conclusion that during flytime cows and horses expend a vast amount of energy. In order to exterminate flies as well as mosquitos, beetles, bugs, ants, hornets and other injurious insects, these animals must swing ponderous tails at great velocity and momentum against offenders. This is a waste of energy, far in excess of that required for their removal. In the East alone, careful calculations definitely prove that cows and horses expend about 3,385,000 horsepower during fly season. In the South and Southwest there are 28,000,000 horses and mules, and 3 times as many cows.

Pondering these figures and worrying about the gasoline drought on the Eastern Seaboard, Fred worked out an invention to utilize the energy wasted by tail-switching. His plan was to apply this captured energy to operations now requiring the use of gasoline—a precious fluid.

Invention Very Simple

The machine, which is not yet in quantity production (priorities, you know), consists of a small generator which is mounted on the backs of horses, cows and other animals, and hooked up with said animals' tails. When the tail is moved, the armature of the generator revolves and a current is produced and stored in batteries. When the cows and horses are taken to the stable in the evening these batteries are removed and the current is utilized in milking the cows, grinding the feed, pumping the water and charging the farmer's batteries. It is Fred's contention that the gasoline heretofore used in operating the machinery can be saved. He estimates that the combined energy produced, once this becomes standard equipment on all animals, will be sufficient to operate all of the Allied submarines and numberless torpedoes.



In order to overcome the difficulty of cold weather, when insects are not so numerous, it is proposed to attach a small spur or calf (see illustration) which will perform the function of a teaser or exciter. The idea, of course, being that the spur or calf will take the place of insects during winter.

As further developments occur they will be recorded in NPN.

COMING MEETINGS

JULY

Detroit Oil Men's Club, Golf Tournament, Grosse Isle Golf and Country Club, Friday, July 9.

OCTOBER

West Virginia Petroleum Assn., Annual Convention Daniel Boone Hotel, Charleston, W. Va., Wed., Oct. 13.

Indiana Independent Petroleum Assn., Inc., Hotel Severin, Indianapolis, Ind., Wed., Thurs., Oct. 13-14.

Mid-Continent Oil & Gas Assn., annual meeting, Blackstone Hotel, Ft. Worth, Tex., Thurs.-Fri., Oct. 14-15.

Petroleum Division, National Assn. of Credit Men, St. Louis, Mo., Mon.-Wed., Oct. 25-26-27.

NOVEMBER

National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago, Ill., Mon.-Wed., Nov. 1-2-3.

Ohio Petroleum Marketers Assn. Inc., annual meeting, Hotel Deshler-Wallick, Columbus, O., Wed.-Thurs., Nov. 3-4.

American Petroleum Institute, 24th annual meeting, York, Mon.-Fri., Nov. 29-30, Dec. 1-2-3.

The American Society of Mechanical Engineers, New Palmer House, Chicago, Ill., Mon.-Thurs., Nov. 8-11.

South Dakota Independent Oil Men's Assn., annual meeting, Mitchell, S. D., Tues.-Wed., Nov. 30-Dec. 1.

DECEMBER

New Mexico Oil & Gas Ass'n., Artesia Hotel, Artesia, New Mexico, Wed., Dec. 1.

19th Exposition of Chemical Industries, Madison Square Garden, New York City, Mon. through Sat., Dec. 6-11.

Nebraska Petroleum Marketers, Inc., Fontenelle Hotel, Omaha, Tues.-Thurs., Dec. 7-8-9.

New Jersey Oil Trade Assn., Inc., annual banquet, Robert Treat Hotel, Newark, N. J., Thurs., Dec. 9.

Detroit Fuel Oil Distributors' Assn., annual meeting, Detroit Oil Men's Club, Leland Hotel, Detroit, Mich., Tues., Dec. 21.

San Joaquin Valley Oil Producers' Assn., Hotel El Tejon, Bakersfield, Cal., Wed., Dec. 29.

FEBRUARY

Iowa Independent Oil Jobbers' Assn., convention, Hotel Fort Des Moines, Des Moines, Ia., Wed.- Thurs., Feb. 23-24.

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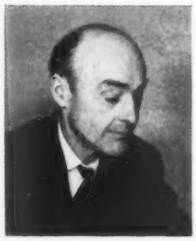

Mr. York

Clark Bros. Co. of Olean, N. Y., have announced the appointment of **John L. York** as advertising manager. Mr. York at one time served as advertising manager for the Metro Stations, Inc., now part of Socony-Vacuum Oil Co., Inc. His experience also includes service with the Waltham Watch Co., both in the U. S. and England; the Watson Co. of Attleboro, Mass.; and short periods with various advertising agencies.

° ° °

T. H. Chamberlain heads a new aviation department at the headquarters in Rockefeller Plaza, N. Y., of American Flange & Manufacturing Co., makers of Tri-Sure Closures.

Mr. Chamberlain has flown in all parts of the world and was once lost for 2 weeks in the swamps of Central Africa while on a flight from London to Cape Town for a business house as the first air representative to fly to a British colony.

° ° °

New director of research for Sherwin-Williams Co. and allied companies is **Dr. Robert F. Ruthruff.** Dr. Ruthruff is widely known for his experimental and research work on various oils, gases, resins and their by-products. Prior to joining the Sherwin-Williams staff in 1939 he was associated with E. I. du Pont de Nemours & Co., Standard Oil Co. of Indiana, and the M. W. Kellog Co. At Indiana Standard he was in charge of experimental cracking, catalytic and high pressure synthesis.

Sights Age When Tire Outlasts Auto, and Auto Outlasts Style

Special to NPN

CINCINNATI—New techniques in production, wide use of synthetic rubber and new metals and alloys may mean that the motorist of the future will find both his car and tires lasting long after greatly improved models have taken their place on the market, Dr. Gustav Egloff, director of research of Universal Oil Products Co., said in creating a verbal post-war picture. Dr. Egloff spoke before the Southern Ohio Postwar Conference of the National Assn. of Manufacturers at the Gibson Hotel here June 21.

Postwar motorists may find themselves buying new cars for their old tires, he said, because synthetic rubber tires produced to exact specifications from petroleum may outwear the rest of the automobile. He warned the danger inherent in this was that things may become outmoded before worn out.

"It will be the job of industry to convert promptly from a war economy to a peace economy and to turn out newer and better articles for public consumption as rapidly as possible," he said, and added that the spur of war had speeded up research so that more had been accomplished in the past two years than had been achieved in fifty pre-war years.

The greatest developments, he believes, will come in the field of airplane and automobile production, which in turn are dependent on the production of suitable fuels and lubricants by the petroleum industry. The petroleum industry in itself, he stated, has advanced in great strides since the beginning of the war.

One obstacle to the greater use of the airplane has been lack of sufficient quantities of efficient fuel which after the war will be present in great abundance. Development of the synthetic rubber industry in the war is showing us how to make ourselves independent of foreign sources of supply and to make rubber available at low cost for a vast number of uses to which it has not yet been applied, he concluded.

Examples cited were a thorough cushioning of railroad cars, better insulation of train bodies and silencing of unnecessary noises from many sources.

Procedure for Uprating Orders is Outlined

NPN News Bureau

CHICAGO—Material supply companies and oil producers in District 2 have had the procedure for uprating orders to AA-2X clarified by PAW in order that they may obtain delivery of equipment when required. How uprating is handled was told in a letter from L. B. Holland, District 2 director of materials.

Orders totaling $1,000 or more, or those which carry a single item of $500 or up, must be submitted to the PAW office in the district where the material is to be used, Mr. Holland said. Operators with approved PD-873 applications for the calendar quarter in which the equipment is required should note the serial number of the PD-873 certificate on delivery orders when submitting them to PAW for uprating. Then, if the material desired is essential to the war effort, the district PAW director may assign the AA-2X rating.

Operators who have not yet filed a PD-873 application for the calendar quarter in question may attach one to the delivery order to be uprated and both will be processed at the same time, according to Mr. Holland.

As soon as uprated delivery orders are returned to the operator, he can notify his supplier of the change, advising him that the "rerating, as outlined in Interpretation No. 1 of CMP Regulation No. 3, takes effect as if the new rating had been applied or extended when the original rating was applied or extended," and thus obtain early delivery of the material.

Delivery orders with total cost of less than $1,000, or with no items over $500 each, may be uprated by the operator himself without first securing approval from the district office of PAW, provided he has secured approval of his PD-873 application for the calendar quarter in which the equipment is to be used. Uprated delivery order should bear the PD-873 serial number.

TRADEMARKS

The following are trademark applications pertinent to our field pending in the United States Patent Office which have been passed for publication and are in line for early registration unless opposition is filed promptly. For further information address National Trade-Mark Company, Munsey Building, Washington, D. C., trademark specialists.

PENOLA-MAR, Ser. 460,099; Standard Oil Co. of New Jersey, Wilmington, Del.; For lubricating oils and greases; Published June 22, 1943.

PENOLAMARINE, Ser. 460,100; Standard Oil Co. of New Jersey, Wilmington, Del; For lubricating oils and greases; Published June 22, 1943.

HANDPIECE EASE, Ser. 455,110; The S. S. White Dental Mfg. Co., Philadelphia, Pa.; For lubricating grease for handpieces, angles, engine arms and motors, and other mechanisms; Published June 22, 1943; "Handpiece" disclaimed.

D on a disk, Ser. 457,273; Joseph Dixon Crucible Co., Jersey City, N. J.; For graphite lubricants.

TENERA OIL, Ser. 460,435; (Oil disclaimed); Shell Oil Co., Inc., San Francisco, Calif.; For petroleum lubricating oil; Published June 29, 1943.

VANTROL, Ser. 454,320, Herbert Van Straaten, Chemical Co., Chicago, Ill. For machine tool lubricants for metal cutting, grinding, honing, lapping, drawing and stamping of all types of metals. Published May 4, 1943.

CYCLO VERSION, on a shield, Ser. 458,972, Phillips Petroleum Co., Bartlesville, Okla. For gasoline. Published May 25, 1943.

HYDROMITE, Ser. 459,464, Filmite Oil Corp., Milwaukee, Wisc. For cutting lubricants. Published May 25, 1943.

BAR-DOL, Ser. 456,687, Pacific Products Corp., Seattle, Wash. For oily lubricants for machinery engine bearings for use under high pressure. Published May 18, 1943.

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NPN's WASHINGTON DIRECTORY of Oil Agency Headquarters

Following is a partial list and directory of governmental agencies in Washington dealing with matters affecting the oil industry. (List is as accurate as possible but is only tentative as room and phone numbers are constantly changing.)
Abbreviations code: Rm for room; Ex for phone extension.

Office of Petroleum Administration for War

New Interior Bldg., 18th and C Sts., N.W.
Phone REpublic 1820

General Information—**Mrs. Rosalie E. Reid,** Rm 6635, Ex 3429-4820.

Administrator
Harold L. Ickes, Rm 6000, Ex 5000.

Deputy Petroleum Administrator
Ralph K. Davies, Rm 6654, Ex 3831.
Bernice Kirschling, personal assistant to Davies, Rm 6654, Ex 3831.
H. Chandler Ide, special assistant to Davies, Rm 6654, Ex 3833.
Dr. Frederick H. Harbison, labor counselor, Rm 6640, Ex 2054.

Director of Organizational Planning
L. S. Fish, Rm 6621, Ex 4813.

Special Assistants
Joseph A. Fanelli, Rm 6132, Ex 5084.
Dr. John W. Frey, Rm 7424, Ex 4272.

Assistant Deputy Petroleum Administrators
Robert E. Allen, Rm 6514, Ex 4401.
Adolph H. Levy, special assistant to Allen, Rm 7514, Ex 4838.
Elmer E. Batzell, special assistant to Allen, Rm 6526, Ex 2181.
Earl J. Opal, chief of review and clearance section, Rm 5226, Ex 2156.
Bruce K. Brown, Rm 6643, Ex 4711.
George E. Dewey, special assistant to Brown, Rm 6642, Ex 3826.
E. DeGolyer, asst. deputy administrator, Rm 6631, Ex 2151.

Administrative Division
Eric L. Kohler, executive officer, Rm 6415, Ex 4174.
E. J. Skidmore, Director, Rm 6412, Ex 4363.

Public Relations Division
Gordon Sessions, director, Rm 7515, Ex 3161.
Herbert A. Yocom, assistant director, Rm 7515, Ex 3181.

Division of Reserves
William B. Heroy, director, Rm 7455, Ex 4454.
Basil B. Zavoico, assistant director, Rm 7447 Ex 4054.

Facility Security Division
Allen A. Jergins, director, Rm 5213, Ex 4172.

Foreign Division
James T. Duce, director, Rm 4212, Ex 4417.
William D. Crampton, associate director, Rm 4211, Ex 4788.
C. Stribling Snodgrass, associate director, Rm 4218, Ex 2968.
A. H. Chapman, assistant to director, Rm 4214, Ex 2655.

Legal Division
J. Howard Marshall, chief counsel, Rm 6515, Ex 3112.
Mortimer A. Kline, associate chief counsel, Rm 6519, Ex 4481.
Robert E. Friedman, assistant chief counsel, Rm 6519, Ex 3114.
Justin R. Wolf, assistant chief counsel, Rm 6525, Ex 2130.
Wallace E. Avery, principal attorney marketing division, Rm 4246, Ex 2978.
George A. Wilson, principal attorney transportation division, Rm 5408, Ex 4898.
Malvin R. Mandelbaum, acting principal attorney, refining div., Rm 5328, Ex 3546.

Marketing Division
Walter Hochuli, director, Rm 4257, Ex 4646.
D. C. Arnold, chief of asphalt section, Rm 4022, Ex 2787.
Howard Cooper, chief of lube oils and containers section, Rm 4244, Ex 4313.
Robert W. MacMillan, chief of marketing equipment section, Rm 4040, Ex 2781.
Kenneth Darling, chief fuel oil section, Rm 4251, Ex 4440.
A. J. Hocking, acting chief, joint use of facilities section, Rm 4347, Ex 4751.
John Downing, chief of motor fuels section, Rm 4258, Ex 3518.
Joseph H. Thompson, chief of administrative section, Rm 4255, Ex 4797.

Materials Division
Frank A. Watts, director, Rm 1444, Ex 4585.
Herbert R. Hansen, assistant director, Rm 1446, Ex 4622.

Natural Gas and Natural Gasoline Division
E. Holley Poe, director, Rm 7314, Ex 4736.
Paul M. Raigorodsky, assistant director, Rm 7316, Ex 4774.
James E. Pew, chief of natural gasoline section, Rm 7330, Ex 4871.
Robert W. Ducker, chief of natural gas section, Rm 7324, Ex 2524.
Paul K. Thompson, chief, liquefied petroleum gas section, Rm 7348, Ex 3448.

Petroleum Supply Division
(Vacant) director, Rm 5210, Ex 2081.
R. C. Sauer, assistant director, Rm 5212, Ex 2081.
Lucien Craig, assistant director, Rm 5224, Ex 2029.

Production Division
Donald R. Knowlton, director, Rm 7410, Ex 4231.
Ralph J. Schilthuis, assistant director, Rm 7416, Ex 2907.
Millard K. Neptune, chief, production operations, Rm 7413, Ex 4826.
David G. Hawthorne, chief of equipment section, Rm 7418, Ex 2062.
Joseph Gordon, chief economics and supply section, Rm 7454, Ex 2984.
R. V. Shirk, chief, reclamation, Rm 7444, Ex 2453.
M. G. Hoffman, chief, facilities, Rm 7427, Ex 4509.
Lt. Milton Williams, chief, development, Rm 7425, Ex 2094.

Refining Division
E. D. Cumming, director, Rm 5257, Ex 3233.
Robert B. Cragin, asst. director, Rm 5024, Ex 3237.
Douglas P. Bailey, chief of operations section, Rm 5040, Ex 4877.
Max B. Miller, chief of construction section, Rm 3312, Ex 4560.
George Parkhurst, chief of new facilities section, Rm 5260, Ex 3941.
Dr. M. R. Mandelbaum, chief of process section, Rm 5328, Ex 4832.

Research Division
Edward B. Swanson, director, Rm 7315, Ex 649.
C. D. Lockwood, assistant director, Rm 7317, Ex 4777.

Transportation Division
Maj. J. R. Parten, director, Rm 5412, Ex 4418.
W. C. Kinsolving, assistant director, Rm 5418, Ex 3557.
Lee R. Cowles, assistant director, Rm 5413, Ex 3658.
Walter B. Lange, assistant director and secretary, Petroleum Supply & Distribution Board, Rm 5323, Ex 4744.
Don F. Sears, chief of pipeline section, Rm 5045, Ex 4833.
Joseph A. Winterberger, chief of tank car section, Rm 5327, Ex 4744.
Boyd Wilson, chief, rail transport section, Rm 5423, Ex 4620.
S. D. Archbold, chief of inland waterways section, Rm 5319, Ex 4333.
John Arch Turner, chief of truck transportation section, Rm 5427, Ex 4300.
Frank I. Brinegar, chief of appraisal section, Rm 5420, Ex 4627.

WPB Representatives at PAW
R. R. McLachlen, Controlled Materials Plan representative, Rm 1547, Ex 4616.
M. C. Schoenly, distribution officer, Rm 1550, Ex 4617.

Liaison
Gen. Walter B. Pyron
Liaison agent between Army and all governmental agencies handling petroleum, Rm 4D577, Ex 5042, Pentagon Bldg., Arlington, Va., REpublic 6700.

Office of Defense Transportation

ICC Bg—Interstate Com. Com. Bldg., 14th and Constitution Ave.
New PO Bg—New Post Office Bldg., 1200 Pennsylvania Ave., N.W.
Barber & Ross Bg—11th and G Streets, N.W.
Tower Bg—14th and K Streets, N.W.
Phone REpublic 7500

General Information, Ex 3550.
Office of the Director
Joseph B. Eastman, director, Rm 5136, ICC Bg—Ex 3527.
Division of Materials and Equipment
H. H. Kelly, director, Rm 2121, ICC Bg—Ex 2206.
Waterways Transport
Ernest Holzborn, asst. O.D.T. director in charge, Rm 5412, ICC Bg—Ex 3616.
Division of Coastwise & Intercoastal Transport
Charles F. Kellers, director, Rm 5412, ICC Bg—Ex 71560.
Division of Inland Waterways
Glenn Taylor, director, Rm 5412, ICC Bg—Ex 3624.
Division of Great Lakes
A. T. Wood, director, Rm 5412, ICC Bg—Ex 3624.
Headquarters 2209 Terminal Bldg., Cleveland, O., CHerry 7900.
Division of Motor Transport
John L. Rogers, director, Rm 4211, ICC Bg—Ex 2297.
Petroleum Carriers Section
Samuel F. Niness, chief, Rm 2406, New PO Bg—Ex 6351.
Division of Petroleum & Other Liquid Transport
Fayette B. Dow, director, Rm 5132, ICC Bg—Ex 73207.
Porter L. Howard, associate director, Rm 5312, ICC Bg—Ex 72795.
Major Joseph E. Keller, transportation corps and consultant on state barriers, Rm 2367, ICC Bg—Ex 72216
H. E. Coyl, consultant, Rm 5310, ICC Bg—Ex 74155.
Pipe Line Section
R. W. Shields, assoc. director, Rm 6310, ICC Bg—Ex 2635.
Tank Car Service Section
A. V. Bourque, assoc. director, Rm 4318, ICC Bg—Ex 75407.
Division of Transport Personnel
Otto S. Beyer, director, Rm 2111, New PO Bg—Ex 71857.

Office of Price Administration

FO Bg 1—Federal Office Building No. 1, 2nd & D Street, S.W.
Temp D Bg—Temporary D Building, 4th and Independence Ave., S.W.
Temp S Bg—Temporary S Building, 4th and Jefferson Drive, S.W.
Phone REpublic 7500

General Information, Ex 5583.
Office of the Administrator
Prentiss M. Brown, National Price Administrator, Rm 4130, FO Bg 1—Ex 5586.
Clyde Herring, Sr., asst. to the administrator, Rm 1130, FO Bg 1—Ex 76307.
Price
J. Kenneth Galbraith, deputy administrator, Rm 5131, FO Bg 1—Ex 5203.
Fuels Division
Sumner T. Pike, director, Rm 6306, FO Bg 1—Ex 76288.
Petroleum Price Branch
Orville Judd, price executive, Rm 6307, FO Bg 1—Ex 5388.
Crude Oil Production Section
Watson B. Joyes, chief, Rm 6315, FO Bg 1—Ex 4403.
Refinery Technique Section
Edward I. Shaeffer, chief, Rm 6316, FO Bg 1—Ex 6226.
Fuel Oil Unit
Peter Jensen, chief, Rm 6314, FO Bg 1—Ex 4916.
Gasoline Unit
Eugene Uman, chief, Rm 6314, FO Bg 1—Ex 6085.
Asphalt Unit
Francis P. Smith, Jr., chief, Rm 6314, FO Bg 1—Ex 73583.
Lubricating Oils Unit
Benjamin Goldberg, chief, Rm 6314, FO Bg 1—Ex 73583.
Refined Products, Retail Section
Charles W. Grenz, chief, Rm 6315, FO Bg 1—Ex 73584.
Fuel Rationing Division
Joel Dean, director, Rm 258, Tem D Bg—Ex 73411.

War Production Board

FHLB—Federal Home Loan Bldg., 2nd and D Sts., S.W.
NMB—New Municipal Bldg., 300 Indiana Ave., N.W.
RRB—Railroad Retirement Bldg., 3rd and C Sts., S.W.
SSB—Social Security Bldg., 4th and Independence Ave., S.W.
WGLB—Washington Gas Light Bldg., 1100 H St., N.W.
Phone REpublic 7500

Executive Office of the Chairman
Donald M. Nelson, chairman, Rm 5055, SSB—Ex 2113.
Smaller War Plants Corporation
Col. Robert W. Johnson, vice-chairman, Rm 316, FHLB—Ex 72318.
Office of Rubber Director
William M. Jeffers, director, Rm 5014, NMB—Ex 3256.
Col. Bradley Dewey, deputy director, Rm 5007, NMB—Ex 2455.
Executive Vice Chairman
C. E. Wilson, Rm 5037, SSB—Ex 2134.
Petroleum Unit
Robert T. Lawrence, chief, 9 Fl, WGLB—Ex 72355.

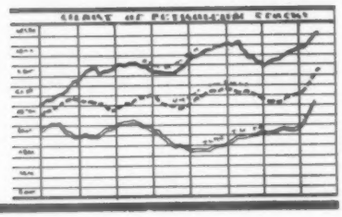
Congress

Congressional Oil Investigating Committee
"Lea Committee"
Rep. Clarence F. Lea, Calif., chairman, New House Office Bldg., Rm 1535, Ex 699.
Senate Oil Shortage Investigating Committee
"Maloney Committee"
Sen. Francis Maloney, chairman, Senate Office Bldg., Rm 354, Ex 1196, Phone NAtional 3120.

Petroleum Industry War Council

Rm 919 Commonwealth Bldg., 1625 K St., N. W., Phone DIstrict 2820.
William R. Boyd, Jr., chairman.
Allan H. Hand, secretary-treasurer.

Oil MARKETS



Mid-Western

CHICAGO, July 3—At beginning of last week majority of refiners reported fuel oil demand at minimum level of past year although still abnormally large. Stocks, greatly depleted, were beginning to accumulate in small quantities although, refiners said, they will in no respect be enough to handle expected demand for summer fills. A rush of inquiries the later part of week from eastern buyers anxious to get as much material out of District 2 as possible was reported by marketers and refiners. Strongest demand, they said, is for kerosine and gas oil. No price changes reported.

Pennsylvania

NEW YORK, July 3—Neutrals were priced 1c higher in western Penna. last week when a refiner advanced his quotations for 200 vis. and 150 vis. 25 p.t. to 25c and 23c, respectively. New price range is now 25-28c for 200 vis., 25 p.t., and 23-26c for 150 vis. 25 p.t. Other refiners reported 1-2c advances which fell within present price ranges.

Light fuels, bright and cylinder stocks tight with bright stock said to be particularly closely held.

Mid-Continent

TULSA, July 3—Low inventories on all refined products were reported by most mid-continent refiners this week and harvesting demand continues unabated. Kansas refiner said his June demand for gasoline was up 10% over a year ago and 24% over May. Many refiners reported having to "ration" customers on all products.

North Texas refiner raised his quotation for third grade gasoline 0.125c to 5.125c this week, falling within the range of 5-5.25c quoted by others. Withdrawal of 3.625c quotation for No. 2 straw fuel was reported by Oklahoma refiner; two continued to quote 3.625c.

Sales of 3 cars Grade 26-70 natural gasoline were reported at 3.875c, f.o.b. Group 3 during the week; no open spot sales reported f.o.b. Breckenridge. One seller quoted 3.5c.

Gulf

NEW YORK, July 3—Several refiners quoted prices 0.25c higher for min. 80 oct. gasoline at the Gulf the past week. Their advances —6.75c—fell within existing price range. Inventories of gasoline were said to be accumulating somewhat because of tighter rationing restrictions and shortage of transportation. New quotations 0.125c higher were reported for both 48-52 and 53-57 d.i. gas oils in cargoes, making prices 4c and 4.125c for the 2 grades, respectively.

Atlantic Coast

NEW YORK, July 3—With most products scarce at ceiling prices little activity was noted along the eastern seaboard during the week ended July 3. No. 2 fuel oil reported extremely scarce, especially in southern areas. No open spot sales or changes in quotations were reported.

California

LOS ANGELES, July 3—Prices generally are firm. Extreme bottom of the gasoline market remains at 5c, 6c, and 7c for the 3 grades. Possibly some Ethyl is going for 6.75c but not in any quantity, reports indicate.

CRUDE PRICES

Since changes in crude oil prices are so few, the 2 pages of crude oil price tables hereafter will be printed only when there are sufficient changes in prices to warrant.

In the meantime a record is being kept in the Cleveland office of NPN and OILGRAM from which the publishers will be glad to make proofs, or letters or affidavits as to what the prices are, and without charge to regular subscribers. Changes in crude oil prices will be specially noted in this market section when made.

Crude Price Changes

Humble Oil & Refg. Co.—Schedule for Panhandle Texas, effective June 16, 1943, begins at $0.80 for Below 20 gravity, 2c differential, ends with $1.22 for 40 & above. Schedule for West Central Texas, effective May 18, 1943 beginning at $0.95 for 25-25.9 gravity and ending at $1.25 for 40 & above, 2c differential.

Magnolia Petroleum Co.—Schedules for Panhandle, Tex. and West Texas are the same as those for Humble Oil & Refg. Co., effective June 16, 1943.

Continental Oil Co.—Carson & Hutchinson Counties, Tex. schedule, effective June 16, is same as Humble Panhandle schedule, except Continental begins with below 29 at $0.98.

(*See NPN June 23, p. 47-48, for latest tables*).

Index of Governmental Orders Concerning Petroleum Prices

Orders, "requests", "ceilings", and other statements issued by governmental agencies concerning prices of petroleum and products, prices for which are published in this market section of NATIONAL PETROLEUM NEWS, have been published as follows:

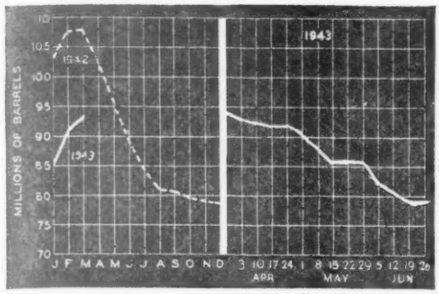
(For orders issued prior to March, see NPN of March 17, p. 47; Jan. 13, p. 41; Jan. 6, p. 41; and Nov. 25, p. 39.)

	NATIONAL PETROLEUM NEWS	PLATT'S OILGRAM	Platt's OIL-Law-GRAM
Mar. 3, '43—New ceilings for residuals and blends set up	Mar. 10, p. 10	Mar. 3, p. 2	P. 300.144
Mar. 16, '43—Fuel oil price increase of .3c extended to Washington and Oregon	Mar. 24, p. 9	Mar. 17, p. 2	P. 300.152 P. 272.54
Mar. 17, '43—Kerosine ceiling raised at Gulf Coast refineries and in District 1	Mar. 24, p. 10	Mar. 18, p. 1	P. 300.153 P. 272.55
Mar. 24, '43—Price basis for crude at well revised	Mar. 31, p. 12	Mar. 24, p. 1	P. 300.157
Mar. 26, '43—California crudes and residual ceiling increased 25c per bbl.	Mar. 31, p. 12	Mar. 26, p. 1	P. 300.159
Mar. 30 '43—Kerosine tank wagon ceiling raised .2c in Hartford, Conn. area	Apr. 7, p. 12	Mar. 30, p. 2	P. 300.167
Apr. 1, '43—California price increase extended to all levels in District 5	Apr. 7, p. 11	Apr. 1, p. 2	P. 300.164
Apr. 2, '43—.3c fuel oil increase extended to 20 Idaho counties	Apr. 7, p. 11	Apr. 3, p. 2	P. 300.169 P. 272.59
Apr. 6, '43—Only aviation gasoline with 87-octane rating or over exempt from price control	Apr. 14, p. 8	Apr. 6, p. 1	P. 272.58
Apr. 10, '43—Discount provisions revised	Apr. 14, p. 8	Apr. 12, p. 1	P. 300.170
Apr. 10, '43—Ceiling set on South Bangor Pool, Van Buren County, Mich. crude	Apr. 14, p. 8	Apr. 12, p. 1	P. 300.171
Apr. 12, '43—All California crude prices increased	Apr. 14, p. 8	Apr. 12, p. 1	P. 300.172
Apr. 22, '43—Ceiling set for Wyoming Elk Basin (Tensleep crude) of 90c per bbl.	Apr. 28, p. 14	Apr. 22, p. 1	P. 300.174
May 17, '43—Ceiling raised for North, North Central Texas and Tillman County, Okla. crude; new maximum set for Tinsley Field, Miss. crude	May 26, p. 14	May 17, p. 2	P. 300.178
May 17, '43—Ville Platte, La. crude ceiling increased	May 26, p. 14	May 17, p. 2	P. 300.180
May 18, '43—Refinery and seaboard ceiling set for No. 2 fuel oil in Boston area	May 26, p. 14	May 21, p. 2	P. 300.185
May 19, '43—Ceiling set for blenders of No. 5 fuel oil in Chicago	May 26, p. 14	May 19, p. 1	P. 300.184
May 27, '43—Specific ceilings set on No. 2 fuel oil in Schenectady, N. Y. area	June 2, p. 11		P. 300.188
May 28, '43—Ceilings set on crudes from Talco and Sulphur Bluff Fields, Tex.	June 9, p. 14	May 31, p. 2	P. 300.192
May 31, '43—Tank wagon ceilings set for kerosine in Greenwich, Waterbury and Norfolk, Conn. areas and in Conway, N. H. area	June 9, p. 14	June 2, p. 2	P. 300.190 P. 272.63
June 3, '43—Texas and Louisiana Gulf Coast prices revised	June 9, p. 14	June 3, p. 2	P. 300.193
June 14, '43—Ceilings increased for retailers who are not tank wagon buyers	June 23, p. 11	June 15, p. 2	P. 272.64
June 14, '43—Specific ceilings set on tank wagon prices for No. 2 fuel oil in New Haven	June 23, p. 11	June 15, p. 2	P. 300.196
June 15, '43—Texas Panhandle crude ceiling increased	June 23, p. 11	June 16, p. 2	P. 300.197
June 24, '43—Tank wagon and steel barrel prices set on fuel oil in Philadelphia	June 30, p. 11	June 25, p. 2	P. 300.200

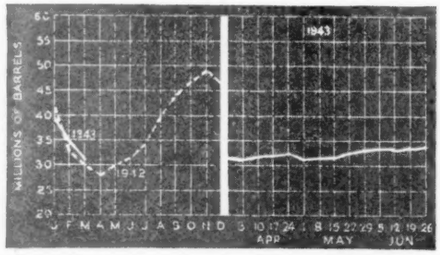
STATISTICS

Monthly figures are actual as reported by Bureau of Mines. Weekly figures are as estimated by American Petroleum Institute on Bureau of Mines basis, except crude stocks which are as reported by Bureau of Mines.

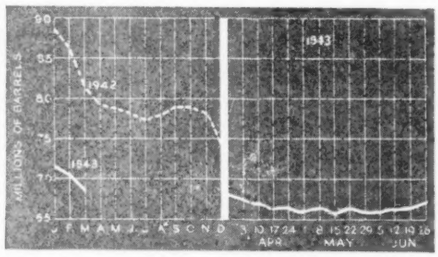
Gasoline Stocks (Finished and Unfinished)



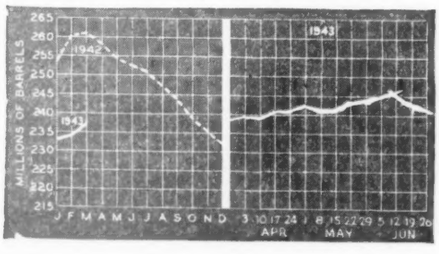
Gas Oil and Distillate Stocks



Residual Fuel Oil Stocks



Crude Stocks



Refinery Operations

(American Petroleum Institute figures in thousands of barrels of 42 gallons each. Figures include reported totals plus an estimate of unreported amounts and are therefore on a Bureau of Mines basis.)

Districts	Daily Potential Refining Capacity Week Ended June 26	Daily Potential Refining Capacity Week Ended June 19	Per Cent of Refining Capacity Reporting Week Ended June 26	Per Cent of Refining Capacity Reporting Week Ended June 19	Daily Average Crude Runs to Stills Week Ended June 26	Daily Average Crude Runs to Stills Week Ended June 19	Per Cent of Reporting Capacity Operated Week Ended June 26	Per Cent of Reporting Capacity Operated Week Ended June 19
Combined**	2,444	2,444	88.7	88.7	1,899	1,832	77.7	75.0
Appalachian	177	177	84.8	84.8	153	157	86.4	88.7
Ind., Ill., Ky.	824	824	85.2	85.2	747	711	90.7	86.3
Okla., Kans., Mo.	416	416	80.1	80.1	360	356	86.5	85.6
Rocky Mt.	147	147	55.9	54.1	104	106	70.7	72.1
California	817	817	89.9	89.9	752	743	92.0	90.9
Total U. S.—B of M. Basis	4,825	4,825	86.4	86.4	4,015	3,905	83.2	80.9
U. S.—B. of M. Basis, June 27, 1942					3,597			

District	Gasoline Production at Refineries inc. Natural Blended Week Ended June 26	Gasoline Production at Refineries inc. Natural Blended Week Ended June 19	Stocks of Finished and Unfinished Gasoline Week Ended June 26	Stocks of Finished and Unfinished Gasoline Week Ended June 19	Total Stocks Gas Oil & Distillates Week Ended June 26	Total Stocks Gas Oil & Distillates Week Ended June 19	Total Stocks Residual Fuel Oil Week Ended June 26	Total Stocks Residual Fuel Oil Week Ended June 19
Combined**	5,103	5,118	31,438	31,368	13,950	13,944	12,403	11,991
Appalachian	432	459	2,426	2,330	987	933	578	575
Ind., Ill., Ky.	2,340	2,345	16,670	17,203	4,856	4,609	3,332	3,181
Okla., Kans., Mo.	1,268	1,165	6,352	6,329	1,818	1,773	1,612	1,569
Rocky Mt.	315	314	1,846	1,846	347	339	622	603
California	1,634	1,751	20,857	20,460	12,086	11,960	49,413	49,536
Total U. S.—B. of M. Basis	11,092	11,152	79,589*	79,806	34,044	33,558	67,960	67,455
U. S.—B of M. Basis June 27, 1942	10,585		88,461		32,206		77,790	

*Finished 69,048,000 bbl.; Unfinished 10,541,000 bbl.

**Includes East Coast, Inland Texas, Texas Gulf, Louisiana Gulf, and North Louisiana-Arkansas districts. District 1 inventory index is 29.5% of normal.

Crude Oil Stocks

(Bureau of Mines Figures in thousands of barrels)

Grade or Origin	June 19	June 26	Change from June 19
Pennsylvania Grade	2,656	2,639	— 17
Other Appalachian	1,380	1,421	+ 41
Lima-Michigan	1,059	1,076	+ 17
Illinois-Indiana	12,038	12,236	+ 198
Arkansas	2,519	2,510	— 9
Kansas	8,758	8,916	+ 158
Louisiana:	15,362	15,029	— 133
Northern	5,131	5,044	— 87
Gulf Coast	10,231	9,985	— 246
Mississippi	1,437	1,536	+ 99
New Mexico	7,049	7,055	+ 6
Oklahoma	37,929	37,507	— 422
Texas:	105,234	105,177	— 57
East Texas	22,157	22,330	+ 173
West Texas	25,056	24,846	— 210
Gulf Texas	30,848	31,124	+ 276
Other Texas	27,173	26,877	— 296
Panhandle	5,635	5,700	+ 65
North	7,450	7,526	+ 76
South	5,148	5,242	+ 94
Other	8,940	8,409	— 531
Rocky Mountain	13,790	13,590	— 200
California	33,923	33,632	— 291
Foreign	382	333	— 49
Total gasoline-bearing in U. S.	243,516	242,657	— 859
Heavy in California	9,769	10,038	+ 269

N.P.N. Gasoline Index

	Dealer T.W. Cents Per Gal.	Tank Car Cents Per Gal.
July 5	10.57	6.75
Month ago	10.57	6.75
Year ago	11.30	7.09

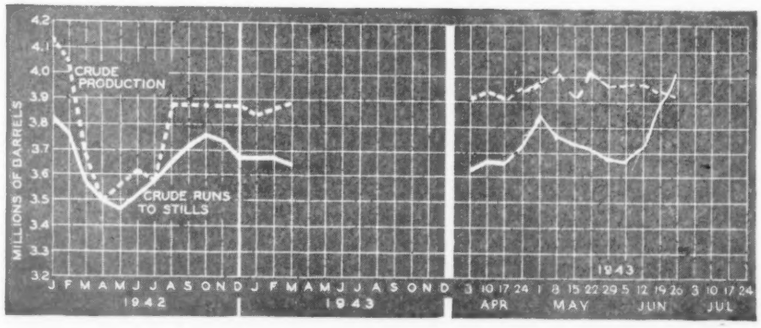
Dealer index is an average of "undivided" dealer prices, ex-tax, in 50 cities.

Tank car index is weighted average of following wholesale markets for regular-grade gasoline, FOB refineries or terminals: Okla., Mid-Western, W. Penna., Calif., N. Y. Harbor, Philadelphia, Jacksonville, Boston and Gulf Coast.

Pennsylvania Crude Runs

(Compiled by National Petroleum Assn. from reports of all companies which refined Pennsylvania crude. Figures in barrels.)

Week Ended	Daily Average	Week Ended	Daily Average
Jan. 2	75,279	Apr. 10	74,317
Jan. 9	70,842	Apr. 17	70,445
Jan. 16	78,155	Apr. 24	76,625
Jan. 23	77,551	May 1	76,555
Jan. 30	74,034	May 8	77,088
Feb. 6	67,494	May 15	79,366
Feb. 13	69,103	May 22	76,684
Feb. 20	78,797	May 29	76,488
Feb. 27	77,285	June 5	71,505
Mar. 6	70,389	June 12	76,766
Mar. 13	73,184	June 19	68,115
Mar. 20	77,828	June 26	69,551
Mar. 27	82,224	1942 Low	67,243
Apr. 3	81,095	1942 High	87,251



U. S. Crude Oil Production

(American Petroleum Institute figures)

	WEEK ENDED June 26 Barrels (Daily Average)	WEEK ENDED June 19 Barrels (Daily Average)		WEEK ENDED June 26 Barrels (Daily Average)	WEEK ENDED June 19 Barrels (Daily Average)
Oklahoma	339,450	334,100	East'n (Ill., Ind. & Ky. excl'd)	76,950	77,900
Kansas	306,950	302,200	Kentucky	19,800	21,400
Nebraska	2,200	2,050	Michigan	54,400	54,400
Texas	1,497,700	1,496,800	Wyoming	92,000	93,300
Louisiana	325,550	326,650	Montana	20,850	20,900
Arkansas	75,150	75,750	Colorado	6,900	7,150
Mississippi	53,100	53,400	New Mexico	97,150	97,150
Illinois	207,750	216,400	California	764,500	771,400
Indiana	14,500	15,200	Total U. S.	3,954,900	3,966,150

REFINERY and SEABOARD PRICES

In bulk lots by Motor Transport, Tank Car, Barge or Tanker as shown

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

HOW PRICES ARE REPORTED—

Refinery and Seaboard prices in National Petroleum News are gathered by PLATT'S OILGRAM and are published in the Monday issue of the OILGRAM.

PLATT'S OILGRAM is a reporting service issued in three identical editions daily from News Bureaus at New York, Cleveland, and Tulsa, Okla. PLATT'S OILGRAM gathers and publishes what its publisher and representatives believe to be accurate news of sales, prices and current happenings affecting the oil industry and that will be of interest to its subscribers. As this information is usually private, OILGRAM reports it according to what it is able to obtain from sources deemed reliable.

All information is supplied without guarantee as to its completeness, accuracy, time of transmission or promptness of delivery.

The subscriber receives this information for his private use and not for resale or further distribution.

Publisher reserves the right to change the extent, nature and form of showing this information at any time.

Prices shown in the tables are quotations (meaning sellers' general offers or posted prices), or actual sales prices, reported to OILGRAM by refiners for "open spot" transactions, except as otherwise specified.

Prices arrived at by discounts off a specified price or "market date of shipment," prices named in contracts or prices arrived at in accordance with any arrangement made prior to date of sale, are not for "open spot" transactions and therefore are not considered in making the price tables. Prices made to brokers and prices in "Inter-refinery" transactions are also not considered except as may be noted.

All prices are for "immediate" shipment except in Gulf Coast bulk transactions where shipment is generally to be made in ninety days. Prices are FOB refineries, pipelines, or tanker terminals in districts designated.

Prices shown are for quantities in bulk such as tank car lots, motor transport lots or barge lots; and in cents per gallon; heavy fuel oils are in dollars per barrel of 42 U.S. gallons; wax and petrolatums are in cents per pound. Prices applying to barges or cargoes only are so designated.

Prices do not include taxes or inspection fees. Prices are published at the close of the business day.

Mid-Western prices in the tables were gathered from refiners with offices located in Chicago and the surrounding territory. While the prices are quoted on a Group 3 (Oklahoma) freight basis, this is in accordance with the custom of the oil industry which uses Group 3 as a price basis for the ease of comparing prices even when the material originates in another refining district. Other refinery prices are given by and for the particular refining district where the material is made and from which it is shipped.

When prices obtained by OILGRAM do not conform to these conditions the exception and the new conditions are noted in the news lead or in conjunction with the price table by footnote or otherwise, for the particular refinery or sales district involved.

Crude oil and products covered by OILGRAM'S news and price service, except where noted, have been represented to the publisher as fully up to the customary trade specifications indicated and according to the generally accepted methods of test: and all crude oil and all products thereof as having been lawfully produced and transported.

Any apparent error should be reported to the nearest OILGRAM or National Petroleum News office at once as no correction will be made after the second issue of the OILGRAM or National Petroleum News following its publication.

NOTICE—Owing to great demand, refiners generally limit quotations to regular customers and refuse bids, though higher, from others. Refiners' prices and sales shown; bids reported in market leads.

Summary of Daily Gasoline Prices (June 28 to July 5)

	Monday July 5	Friday July 2	Thursday July 1	Wednesday June 30	Tuesday June 29
U. S. Motor (ASTM octane)					
78 octane Ethyl:					
Oklahoma	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875
Mid-Western (Group 3 basis)	6.75 – 7.125	6.75 – 7.125	6.75 – 7.125	6.75 – 7.125	6.75 – 7.125
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6.6 – 7	6.6 – 7	6.6 – 7	6.6 – 7	6.6 – 7
W. Tex. (For shpt. to Tex & N. M. dest'ns.)	7 (2	7(2)	7(2)	7(2)	7(2)
72-74 octane:					
Oklahoma	5.875– 6	5.875– 6	5.875– 6	5.875– 6	5.875– 6
Mid-Western (Group 3 basis)	5.875– 6	5.875– 6	5.875– 6	5.875– 6	5.875– 6
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.8 – 6	5.8 – 6	5.8 – 6	5.75 – 6	5.75 – 6
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	6
63-66 octane:					
Oklahoma	5.5 – 5.625	5.5 – 5.625	5.5 – 5.625	5.5 – 5.625	5.5 – 5.625
Mid-Western (Group 3 basis)	5.5 – 5.625	5.5 – 5.625	5.5 – 5.625	5.5 – 5.625	5.5 – 5.625
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.4 – 5.5	5.4 – 5.5	5.4 – 5.5	5.4-5.625	5.4 – 5.625
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.75(1)	5.75(1)	5.75(1)	5.75(1)	5.75(1)
60 octane & above:					
Oklahoma	5.125– 5.25	5.125– 5.25	5.125– 5.25	5.125– 5.25	5.125– 5.25
Mid-Western (Group 3 basis)	5.1 – 5.25	5.1 – 5.25	5.1 – 5.25	5.1 – 5.25	5.1 – 5.25
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	4.875– 5.25	4.875– 5.25	5.875– 5.25	4.875– 5.25	4.875– 5.25
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.25	5.25	5.25	5.25	5.25
Motor Gasoline, 72-74 octane (ASTM)					
New York harbor	9.2 – 9.4	9.2 –10.2	9.2 –10.2	9.2 –10.2	9.2 –10.2
New York harbor, barges	9.1 – 9.3	9.1 – 9.3	9.1 – 9.3	9.1 – 9.3	9.1 – 9.3
Philadelphia district	9.2	9.2 – 9.7	9.2 – 9.7	9.2 – 9.7	9.2 – 9.7
Baltimore district	8.95	8.95	8.95	8.95	8.95
Motor Gasoline:					
Western Penna. Bradford-Warren:					
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.5–8.95	7.5–7.75(2)	7.5–7.75(2)	7.5–7.75(2)	7.5–7.75(2)
Western Penna. Other Districts:					
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.25 – 7.75	7.25 – 7.3	7.25 – 7.3	7.25 – 7.3	7.25 – 7.5

REFINERY PRICES

Gasoline—U. S. Motor (ASTM) except where otherwise specified

Prices in Effect	July 5	June 28
OKALHOMA		
78 oct. Ethyl	6.75 – 6.875	6.75 – 6.875
72-74 oct.	5.875– 6	5.875– 6
63-66 oct.	5.5 – 5.625	5.5 – 5.625
60 oct. & below	5.125– 5.25	5.125– 5.25
60-62, 400 e.p.	5.125 (1)	5.125 (1)
MID-WESTERN (Group 3 basis)		
78 oct. Ethyl	6.75 – 7.125	6.75 – 7.125
72-74 oct.	5.875– 6	5.875– 6
63-66 oct.	5.5 – 5.625	5.5 – 5.625
60 oct. & below	5.1 – 5.25	5.1 – 5.25
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
78 oct. Ethyl	6.6 – 7	6.6 – 7
72-74 oct.	5.8 – 6	5.8 – 6
63-66 oct.	5.4 – 5.5	5.4 – 5.5
60 oct. & below	5 – 5.25	5 – 5.25
60-62, 400 e.p.	5.375 (1)	5.375 (1)
W. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
78 oct. Ethyl	7 (2)	7 (2)
72-74 oct.	6	6
63-66 oct.	5.75 (1)	5.75 (1)
60 oct. & below	5.25	5.25
CENT. W. TEX. (Prices to truck transports)		
80 oct. & above	7 (2)	7 (2)
72-74 oct.	6 (2)	6 (2)
67-69 oct.	.....	.....
62 oct. & below	5.25(2)	5.25(2)
AMARILLO, TEX. (For shpt. to W. Okla. & Tex. differential territory.)		
60 oct. & below	No Price	No Price
60-62, 400 e.p.	No Price	No Price
KANSAS (For Kansas destinations only)		
78 oct. Ethyl	7.25 (1)	7.25 (1)
72-74 oct.	6 –6.2 (2)	6 –6.2 (2)
63-66 oct.	5.625–5.8 (2)	5.625–5.8 (2)
60 oct. & below	5.25 –5.4 (2)	5.25 –5.4 (2)

Prices in Effect	July 5	June 28
ARK. (For shipment to Ark. & La.)		
72-74 oct., leaded	6 (1)	6 (1)
70-72 oct. "	5.875 (1)	5.875 (1)
62 oct. "	5.5 (1)	5.5 (1)
60 oct. & below, unleaded	5.375 (1)	5.375 (1)
WESTERN PENNA. (Motor gasoline)		
Bradford-Warren:		
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.5 – 8.95	7.5 – 8.95
Other districts:		
"Q" Gasoline Min. 70 Oct. (ASTM)	7.25 – 7.3	7.25 – 7.3
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
U.S. Motor: (Oct. ASTM):		
72-74 oct.	8 – 8.5	8 – 8.5
67-69 oct.	7.5 (1)	7.5 (1)
Str. run gasoline, excluding Detroit shpt.	5.5 – 6	5.5 – 6
OHIO (S. O. Ohio quotations for statewide delivery and subject to exceptions for local price disturbances)		
72-74 oct.	8.375	8.375
CALIFORNIA U.S. Motor:		
78 oct. & above (Ethyl)	7 – 8.75	7 – 8.75
70-75 oct. (regular)	6 – 7.75	6 – 7.75
65 oct. & below (3rd grade)	5 – 6.75	5 – 6.75

Kerosine, & Gas Fuel Oils

Prices in Effect	July 5	June 28
OKLAHOMA		
41-43 grav. w.w.	4.375– 4.5	4.375– 4.5
42-44 grav. w.w.	4.5	4.5
Range Oil	4 – 4.125	4 – 4.125
No. 1 P.W.	3.875	3.875
No. 1 straw	3.875–4 (1)	3.875–4 (1)
No. 2 straw	3.625 (2)	3.625(2)
No. 3 fuel	3.5 (2)	3.5 (2)
U. G. I. Gas Oil	3.625–3.75 (1)	3.625–3.75(1)
No. 6 fuel	.....	.....
14-16 fuel	$0.97	$0.97
MID-WESTERN (Group 3 basis)		
41-43 grav. w.w.	4.375	4.375
42-44 grav. w.w.	4.5	4.5
Range Oil	4 – 4.1	4 – 4.1
No. 1 p.w.	3.875 (1)	3.875 (1)
No. 2 straw	3.625	3.625
No. 3	3.5 (2)	3.5 (2)
No. 5	$0.85 (1)	$0.85 (1)
No. 6	$0.80 (1)	$0.80 (1)
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
41-43 grav. w.w.	4.25 – 4.75	4.25– 4.75
No. 1 P.W.	4.1 –4.2 (2)	4.1 –4.2 (2)
AMARILLO, TEX. (For shpt. to W. Okla. & Tex. differential territory.)		
41-43 grav. w.w.	No Price	No Price
No. 1 straw	No Price	No Price
KANSAS (For Kansas destinations only).		
41-43 grav. w.w.	No Price	No Price
42-44 grav. w.w.	4.7–4.875 (2)	4.7–4.875 (2)
No. 1 p.w.	4.1–4.25 (2)	4.1–4.25 (2)
No. 6 fuel	$0.85 (1)	$0.85 (1)

REFINERY PRICES (Continued)

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

NOTICE—Owing to great demand, refiners generally limit quotations to regular customers and refuse bids, though higher, from others. Refiners' prices and sales shown: bids reported in market leads.

Kerosine, & Gas Fuel Oil
(Continued)

Prices in Effect	July 5	June 28
ARK. (For shipment to Ark. and La.)		
41-43 grav. w.w.	4.625 (1)	4.625 (1)
No. 1	4 (1)	4 (1)
No. 2	3.5 (1)	3.5 (1)
No. 3 fuel	3.5 (1)	3.5 (1)
Tractor fuel, tar shpt to Ark. points only	5.125 (1)	5.125 (1)
WESTERN PENNA.		
Bradford-Warren:		
45 grav. w.w.	6.55 – 8.05	6.55– 8.05
46 grav. w.w.	6.675 (1)	6.675 (1)
No. 1 fuel	6.55 – 8.05	6.55 – 8.05
No. 2 "	6.625–7.625 (2)	6.625-7.625(2)
No. 3 "	6.625–7.75 (2)	6.625-7.75 (2)
36-40 gravity	6.625–6.75 (2)	6.625-6.75(2)
Other districts:		
45 grav. w.w.	6.75 – 7.925	6.75 – 7.925
46 grav. w.w.	6.875– 7	6.75 – 6.925
47 grav. w.w.	7 – 7.125	6.375– 7.125
No. 1 fuel	6.625	6.625
No. 2 "	6.5 – 7.125	6.5 – 7.125
No. 3 "	6.5 – 7.125	6.5 – 7.125
36-40 grav., Pittsburgh dist. prices excluded	6.5 – 7	6.5 – 7
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
47-49 gravity w.w.	5.8 – 6	5.8 – 6
P.W. Distillate	5.5	5.5
No. 3 gas oil, Straw	5	5
U.G.I. gas oil	4.5 (2)	4.5 (2)
Fuel Oils (Vis. at 100):		
300-500 Vis.	....	....
100-300 Vis.	4.5	4.5
OHIO (S. O. quotations for statewide delivery)		
Kerosine	7	7
CALIFORNIA		
40-43 grav. w.w.	5 – 7	5 – 7
San Joaquin Valley:		
Heavy fuel	$1.10 (2)	$1.10 (2)
Light fuel	$1.20(2)	$1.20(2)
Diesel fuel	4 (2)	4 (2)
Stove dist.	3 – 5 (2)	3 – 5 (2)
Los Angeles:		
Heavy fuel	$1.10 (2)	$1.10(2)
Light fuel	$1.20(2)	$1.20(2)
Diesel fuel	3.5– 4	3.5– 4
Stove dist.	3 – 5	3 – 5
San Francisco:		
Heavy fuel	$1.15 (1)	$1.15 (1)
Light fuel	$1.25 (1)	$1.25 (1)
Diesel fuel	4.5 (1)	4.5 (1)
Stove dist.	5.5 (1)	5.5 (1)

Note: All above heavy fuels meet Pacific specification 400; light fuel, spec. 300; Diesel fuels, spec. 200; and stove distillate, spec. 100.

Lubricating Oils

WESTERN PENNA.

Prices are for sales made, or offers reliably reported, to jobbers & compounders only.

Viscous Neutrals—No. 3 col. Vis. at 70°F.

200 Vis. (180 at 100°) 420-425 fl.		
0 p.t.	31.5 (1)	31.5 (1)
10 p.t.	30.5 (1)	30.5 (1)
15 p.t.	29.5 (1)	29.5 (1)
25 p.t.	25–28	25-28
150 Vis. (143 at 100°) 400-405 fl.		
0 p.t.	29.5 (1)	29.5 (1)
10 p.t.	28.5 (1)	28.5 (1)
15 p.t.	27.5 (1)	27.5 (1)
25 p.t.	23–26	23-26

(b) Offered by Mid-Western sales agent at 1c off low.

Cylinder Stocks

Brt. stk., 145-155 vis. at 210°, 540-550 fl., No. 8 eol.		
10 p.t.	30.5 (1)	30.5 (1)
15 p.t.	29.5 (1)	29.5 (1)
25 p.t.	25	25
600 S.R. filterable	15	15
650 S.R.	15.5	15.5
600 fl.	16	16
630 fl.	17	17
MID-CONTINENT (F. o. b. Tulsa)		
Neutral Oils (Vis. at 100° F. 0 to 10 P.P.)		
Pale Oils:		
Vis. Color		
60-85—No. 2	8	8
86-110—No. 2	8.5 (2)	8.5 (2)
150—No. 3	14.5	14.5
180—No. 3	15	15
200—No. 3	15	15
250—No. 3	16-16.5	16-16.5
280—No. 3	17	17
300—No. 3	18 (2)	18 (2)

Lubricating Oils (Cont'd)

Prices in Effect	July 5	June 28
Red Oils:		
180—No. 5	15 (1)	15 (1)
200—No. 5	15 (1)	15 (1)
280—No. 5	No Price	No Price
300—No. 5	17.5 (2)	17.5 (2)

Note: Viscous Neutrals, 15-25 p.p. generally are quoted 0.5c under 0-10 p.p. oils. Non-viscous oils, 15-25 p.p.; generally are quoted 0.25c under 0-10 p.p. oils.

Bright Stock—Vis. at 210°		
200 Vis. D	27 (1)	27 (1)
150-160 Vis. D:		
0 to 10 p.p.	23	23
10 to 25 p.p.	22.5–23	22.5–23
25 to 40 p.p.	23 (1)	23 (1)
150-160 Vis. E	22 (1)	22 (1)
120 Vis. D:		
0 to 10 p.p.	22 (2)	22 (2)
600 S.R. Dark Green	8.5 (1)	8.5 (1)
600 S.R. Olive Green	10–11	10–11
631 S.R.	18.5 (1)	18.5 (1)
Black Oil	5.5 (1)	5.5 (1)

QUALIFYING PRICE NOTE: Prices on neutrals are posted prices from which refiners allow special discounts, ranging to 3c to meet varying local competition.

SOUTH TEXAS Neutral Oils

Vis. Color		
Pale Oils: (*Vis. at 100°F.*)		
100 No. 1½-2½	6.5	6.5
200 No. 2-3	8.75	8.75
300 No. 2-3	9.25	9.25
500 No. 2½-3½	10	10
750 No. 3-4	10.25	10.25
1200 No. 3-4	10.375	10.375
2000 No. 4	10.5	10.5
Red Oils:		
100 No. 5-6	6.5 (2)	6.5 (2)
200 No. 5-6	8.75	8.75
300 No. 5-6	9.25	9.25
500 No. 5-6	10	10
750 No. 5-6	10.25	10.25
1200 No. 5-6	10.375	10.375
2000 No. 5-6	10.5–11.5	10.5–11.5

CHICAGO (From Mid-Continent p.l. crude.)

Neutral oils (Vis. at 100° F. 0 to 10 p.p.)

Pale Oils Vis. Color		
60-85—No. 2	9.5 (1)	9.5 (1)
86-110—No. 2	10 (1)	10 (1)
150—No. 3	15.5 (1)	15.5 (1)
180—No. 3	16 (1)	16 (1)
200—No. 3	16 (1)	16 (1)
250—No. 3	17	17
Red Oils:		
180—No. 5	16 (1)	16 (1)
200—No. 5	16 (1)	16 (1)
250—No. 5	17 (1)	17 (1)
280—No. 5	18 (1)	18 (1)
300—No. 5	18.5 (1)	18.5 (1)

Note: Viscous oils, 15 to 30 p.p. are quoted 0.5c lower; 60-85 and 86-110 No. 2 non-viscous oils, 15 to 30 p.p., 0.25c lower.

Unfiltered Steam Refined: (Viscosity at 210°)		
140	11.5 (1)	11.5 (1)
160	12.5 (1)	12.5 (1)
200	13.5 (1)	13.5 (1)
Bright stocks, 160 vis. at 210 No. 8 color:		
0 to 10 p.p.	24 (1)	24 (1)
15 to 25 p.p.	23.5 (1)	23.5 (1)
30 to 40 p.p.	21.5 (1)	21.5 (1)
E filtered Cyl. Stock	15.5 (1)	15.5 (1)

Note: To obtain prices delivered in Chicago, add 0.25c per gal

Natural Gasoline

(Group 3 & Breckenridge prices are to blenders on freight basis shown below. Shipments may originate in any Mid-Continent manufacturing district.)

FOB GROUP 3		
Grade 26-70	3.875 (Qtns.)	3.875 (Qtns.)
FOB BRECKENRIDGE		
Grade 26-70	3.5 (Qtns.)	3.5 (Qtns.)
CALIFORNIA (FOB plants in Los Angeles basin)		
21 pound vapor pressure for blending	4.75 – 5.375	4.75 – 5.375

Naphtha and Solvent

Prices in Effect	July 5	June 28
(FOB Group 3)		
Stoddard solvent	6.625	6.625
Cleaners' naphtha	7.125	7.125
V. M. & P. naphtha	7.125	7.125
Mineral spirits	6.125	6.125
Rubber solvent	7.125	7.125
Lacquer diluent	7.375– 8.125	7.375– 8.125
Benzol Diluent	8.375– 8.625	8.375– 8.625
WESTERN PENNA.		
Bradford-Warren District:		
Stoddard Solvent	7.5 (1)	7.5 (1)
Other Districts:		
Untreated naphtha	7 – 7.25	7 – 7.25
Stoddard solvent	7 – 7.75	7 – 7.75
OHIO (S. O. quotations for statewide delivery):		
V.M.&P. naphtha, D.C. naphtha, Varnolene & Sohio solvent	10	10
Rubber solvent	9	9

Wax

White Crude Scale:

WESTERN PENNA. (Bbls. C.L.)		
122-124 A.m.p.	4.25 (2)	4.25 (2)
124-126 A.m.p.	4.25	4.25
OKLAHOMA (C.L. FOB Refinery)		
Semi-refined:		
128 AMP min., white, 50 kilo bags	No Price	No Price
132-134 AMP, bbls.	5.25 (1)	5.25 (1)

CHICAGO (FOB Chicago district refinery of one refiner, in bags, carloads. Carloads, slabs loose 0.4c less. Melting points are EMP (ASTM) methods; add 3° to convert into AMP.)

Fully refined:		
122-124 (bags only)	5.6	5.6
125-127	6	6
127-129	6.25	6.25
130-132	6.55	6.55
132-134	6.8	6.8
135-137	7.55	7.55

Petrolatums

WESTERN PENNA. (Bbls., carloads; tank cars, 0.5c per lb. less.)		
Snow White	6.125– 7.25	6.125– 7.25
Lily White	5.375– 6.125	5.375– 6.125
Cream White	4.375– 5.125	4.375– 5.125
Light Amber	3.375– 3.875	3.375– 3.875
Amber	3.125– 3.5	3.125– 3.5
Red	3 – 3.25	3 – 3.25

Group 3 Freight Rates

To Division Headquarters Points of Standard Oil Co. of Indiana

(Cents Per Gal.)

	Gasoline Kerosine	*Distillate Fuel Oil	Gas Oil and/or Residual Fuel Oil
Chicago, Ill.	2.376	2.368	2.368
Decatur, Ill.	2.112	2.112	2.294
Joliet, Ill.	2.376	2.368	2.368
Peoria, Ill.	2.178	2.178	2.294
Quincy, Ill.	2.046	2.046	2.146
Indianapolis, Ind.	2.508	2.886	2.886
Evansville, Ind.	2.310	2.738	2.738
South Bend, Ind.	2.904	2.970	3.108
Detroit, Mich.	4.026	3.774	3.774
Grand Rapids, Mich.	3.597	3.597	3.700
Saginaw, Mich.	4.026	3.922	3.922
Green Bay, Wis.	2.706	2.706	3.034
Milwaukee, Wis.	2.574	2.553	2.553
La Cross, Wis.	2.442	2.442	2.738
Minneapolis-St. Paul	2.442	2.442	2.738
Duluth, Minn.	2.706	2.706	3.071
Mankato, Minn.	2.442	2.442	2.738
Des Moines, Ia.	1.914	1.914	2.146
Davenport, Ia.	2.178	2.178	2.294
Mason City, Ia.	2.244	2.244	2.479
St. Louis, Mo.	1.914	1.914	1.961
Kansas City, Mo.	1.452	1.452	1.665
St. Joseph, Mo.	1.452	1.452	1.665
Fargo, N. D.	3.366	3.366	3.737
Huron, S. D.	2.838	2.838	3.145
Wichita			
From Ponca City	0.561	0.561	0.629
From Tulsa	0.391	0.391	0.999
From Cushing	0.825	0.825	0.925

*Not suitable for illuminating purposes.

SEABOARD PRICES EXPORT AND COASTWISE

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

NOTICE—Owing to great demand, refiners generally limit quotations to regular customers and refuse bids though higher, from others. Refiners' prices and sales shown; bids reported in market leads.

Atlantic Coast

(Prices are of refiners, FOB their refineries & their tanker terminals, & of tanker terminal operators FOB their terminals)—Prices In Effect July 5

MOTOR GASOLINE

District:	Min. 80 Oct. '39 Research (Max. 2 cc Lead)	72-74 Oct. (ASTM)	68-70 Oct. (ASTM)
N. Y. Harb.	....	9.2 – 9.4	9.2(1)
N. Y. Harb., barges	....	9.1 – 9.3	9.1(1)
Albany	....	9.3 – 9.5	....
Philadelphia	....	9.2	....
Baltimore	....	8.95	8.85(1)
Norfolk	....	8.7	8.5(1)
Wilmington, N. C.	....	8.7 – 8.8	8.5(1)
Charleston	....	8.7 – 8.8	8.1(1)
Savannah	....	8.25 – 8.4	....
Jacksonville	....	8.27-8.275(2)	....
Miami	....	8.27	....
Tampa	....	8.27 – 8.4	8.275(1)
Pensacola	....	7.2-7.2(1)	....
Mobile	....	7 – 7.2	....
New Orleans	....	6.125- 6.75	....
Portland	....	9.5 – 9.65	....
Boston	....	9.4 – 9.7	9.7(1)
Providence	....	9.4 – 9.7	....

FUEL OILS

	KEROSINE and/or NO. 1 FUEL	No. 2	No. 3	No. 5	No. 6
N. Y. Harb.	7.1	6.7	6.7	$1.95-$2.01(a)	$1.65 -$2.07
N. Y. Harb., barges	7	6.6	6.6	....	....
Albany	7.3	6.8	6.8(2)	$2.25(1)	$1.85-$2.27(1)
Philadelphia	7.2	6.7	6.7	$1.98	$1.65-$2.07
Baltimore	7.2	6.7	6.7	....	$1.65-$2.07
Norfolk	7.1	6.7	6.7(1)	....	$1.65-$2.07(2)
Wilmington, N. C.	7.05	6.7	....	....	....
Charleston	7.2	6.7(2)	....	....	$1.60-$2.07(2)
Savannah	7.05	....	....	....	$1.60-$2.02(1)
Jacksonville	7.05(2)	6.25	....	....	$1.60-$2.02(1)
Miami	7.05(2)	....	....	....	....
Tampa	7.05	6.25(2)	....	....	$1.50-$1.92(1)
Pensacola	4.8 (1)	....	....	....	....
Mobile	4.75-5.05(2)	....	....	....	....
New Orleans	4.25 – 4.75	3.75(2)	....	$1.27(1)	$0.85-$1.27(2)
Portland	7.3	6.8	6.8(2)	$2.25(1)	$1.65-$2.07(1)
Boston	7.2	6.7	6.7(2)	$1.95-$2.07(2)	$1.65-$2.07
Providence	7.2	6.7	6.7(2)	$1.90-$1.95(2)	$1.65-$2.07

(a) This price is for a straight-run low pour test No. 5 fuel.

	Bunker C Fuel Ships' bunkers (Ex Lighterage)	Diesel Oil Ships' bunkers (Ex Lighterage)	Diesel Oil Shore Plants	Gas House Gas Oil 28-34 Gravity
N. Y. Harbor	$1.65-$2.07	$2.78	6.7-6.8(2)	6.8(2)
Albany	$1.85(1)	$2.98(1)	6.8(1)	7(1)
Philadelphia	$1.65-$2.07	$2.78	....	....
Baltimore	$1.65-$2.07	$2.78	6.7(1)	6.7(1)
Norfolk	$1.65-$2.07	$2.78	6.7(1)	6.7(1)
Charleston	$1.60-$2.02	$2.78(2)	6.7(1)	6.7(1)
Savannah	$1.60-$2.02 (1)	$2.62(1)	....	....
Jacksonville	$1.60-$2.02 (2)	$2.62(2)	....	....
Tampa	$1.50-$1.92	$2.62(2)	....	....
New Orleans	$0.97-$1.09	$1.65(1)	4(1)	....
Portland	$1.65-$2.07 (1)	$2.86(2)	6.8(1)	6.9(1)
Boston	$1.65-$2.07	$2.78	6.7(2)	6.8(2)
Providence	$1.65-$2.07	$2.78(2)	6.7(1)	6.8(1)

Residual fuel prices generally vary with A.P.I. specifications from range low for 9.9 & below degrees to range high for 25.0 & above.

Pacific Export

(Quotations at seaboard, Los Angeles, cargo lots except where otherwise noted.)

Prices in Effect	July 5	June 28
375 e.p. blend, 70 oct.	No Price	No Price
390 e.p. blend, 68 oct.	No Price	No Price
390 e.p. blend, 66 oct.	No Price	No Price
400 e.p. blend, 65 oct. min.	No Price	No Price
U. S. Motor, under 65 oct.	No Price	No Price
38-40 grav., w.w. kero., 150 fire point	No Price	No Price
41-43 grav., w.w. kero.	No Price	No Price
44 grav. w.w. kero	No Price	No Price
Diesel fuel, 24 & above	No Price	No Price
Diesel fuel, under 24	No Price	No Price
30-34 grav. diesel (gas oil) Pac. Spec. 200	No Price	No Price
Grade C fuel, Pac. Spec. 400	No Price	No Price

In Ship's Bunkers, or deep tank lots:

Diesel Fuel, Pac. Spec. 200	$1.40 -$1.45	$1.40 -$1.45
Grade C fuel, Pac. Spec. 400	$1.10	$1.10

Cased Goods: (Per case)

375-400 e.p. blend, 65 oct. & above	No Price	No Price
400 e.p. blend under 65 oct	No Price	No Price
U. S. Motor	No Price	No Price
40-43 grav., w.w. kero., 150 fire point	No Price	No Price
Kero., p.w.	No Price	No Price

MID-CONTINENT LUBES

(At Gulf; in packages, FAS.; in bulk, FOB terminals)

Prices in Effect July 5

	Steel Drums	Bulk
200 Vis. D 210 brt. stock	35 (1)	28.8 (1)
150 vis. D 210 brt. stock 0-10 p.p.	31 (1)	24.8 (1)
10-25 p.p.	....	....
100 vis. D 210 brt. stock 0-10 p.p.	....	....
10-25 p.p.	....	....
200 vis. No. 3 col. neutral: 0-10 p.p.	....	....

Wax

(Melting points are AMP, 3° higher than EMP. Prices are FOB refinery and do not include bag, freight or export differentials).

Prices In Effect July 5

Crude Scale	New Orleans Export	N. Y. Domestic	N. Y. Export
124-6 Yellow	4.25(1)	....	4.25(1)
122-4 White	....	4.25(2)	4.25(2)
124-6 White	4.25(1)	4.25	4.25
Fully Refined:			
123-5	5.2(1)	5.2(2)	5.2(1)
125-7	5.2(1)	5.2(2)	5.2(1)
128-30	5.6(1)	5.6	5.6(1)
130-32	5.85(1)	5.85(2)	5.85(1)
133-5	6.15(1)	6.15	6.15(1)
135-7	6.4(1)	6.4(1)	6.4(1)

Tanker Rates

(Approximate last paid rates, cents per bbl; Gulf-N. Atlantic, not East of N. Y.)

Hvy. Crude & Fuel (10 to 19.9 gravity)	48
Light Crude, (30 grav. or Lighter)	43
Gasoline	40
Kerosine	40
No. 2 Fuel	42

Note: Increased wartime operating expenses in excess of above rates absorbed by War Shipping Administration.

Gulf Coast

Prices in Effect July 5

	New Orleans & Lower Mississippi to Baton Rouge Tank Cars	New Orleans & Lower Mississippi to Baton Rouge Barge	Texas Gulf Coast South of New Orleans Tank Cars	Texas Gulf Coast South of New Orleans Barges	CARGOES Domestic & Export From all Gulf Ports
MOTOR GASOLINE					
Leaded (oct. by ASTM)					
80 oct. min. Max. 3 cc lead	6.5 – 6.75	6.5 – 6.75	6.75	6.75	6 – 6.75
72-74 oct.	6.125	5.75	5.75	5.75	5.75
63-65 oct.	....	....	....	....	....
Unleaded 70 oct.	....	....	....	....	5.625- 5.75
67-68 oct.	....	....	....	....	5.5 – 5.625
65 oct.	....	5.25	....	....	5.25
60 oct.	....	....	....	....	5
KEROSINE & LIGHT FUELS					
41-43 w.w. kero.	4.125- 4.75	4.125- 4.75	4.125- 4.25	4.125	4.125
42-44 w.w. kero.	....	....	4.125	4.125	4.125
No. 2 fuel oil	3.75	3.75	3.75 – 4	3.75	3.75
DIESEL & GAS OILS					
(In diesel index No.)					
Below 43 di.	....	....	....	....	3.75
43-47 di.	....	....	....	....	3.875– 4
48-52 di.	4	4	4	4	4 (a)
53-57 di.	4.125	4.125	4.125	4.125	4.125 (a)
58 and above	....	....	....	....	4.25

Above products in Truck Transports of 2,400 gal. and over ½c above Tank Car Prices.

NOTE—Prices for heavy fuels vary within the range given above according to gravity from 9.9 grav. and below to 25 B and above. (a) These prices correct on and since June 28, 1943.

Naphtha

Prices in Effect July 5

	V.M.&P. Naphtha	Mineral Spirits
New York Harbor	11 (2)	10
Philadelphia district	11 (2)	10
Baltimore	10.5 (2)	9.5
Boston	11.5 (2)	10.5
Providence	11.5 (1)	10.5 (2)

HEAVY FUELS & BUNKER OILS (At all Gulf Ports)	In Cargoes	In Ship's Bunkers (Ex. lighterage)
Heavy Diesels		
Below 28 API Grav.	....	$1.35
28 API Grav. & Above	....	$1.65
Bunker C Oil	$0.85-$1.27	$0.85 -$1.27

TANK WAGON PRICES

Commercial or consumer tank car, tank wagon, dealer, and service station prices for gasoline **do not include taxes;** *they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include 1.5c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes where levied are indicated in footnotes. Dealer discounts are shown in footnotes. These prices in effect July 5, 1943 as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

S. O. New Jersey

Esso (*Regular Grade*)

	Consumer Tank Wagon	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
*Atlantic City, N. J	10.2	10.7	4.5	10
*Newark, N. J	10.2	10.7	4.5	10
Annapolis, Md	10.55	11.05	5.5	....
Baltimore, Md	9.95	10.45	5.5	10.8
Cumberland, Md	11.35	11.85	5.5	12.3
Washington, D. C	10.2	10.7	4.5	11.3
Danville, Va	11.65	12.15	6.5	12.55
Norfolk, Va	10.45	10.95	6.5	12.3
Petersburg, Va	10.75	11.25	6.5	13.3
Richmond, Va	10.75	11.25	6.5	13.3
Roanoke, Va	11.95	12.45	6.5	12.8
Charleston, W. Va	12.25	12.75	6.5	13.6
Parkersburg, W. Va	11.55	12.05	6.5	13.3
Wheeling, W. Va	11.55	12.05	6.5	13.9
Charlotte, N. C	12.1	12.6	7.5	11.6
Hickory, N. C	12.65	13.15	7.5	12.6
Mt. Airy, N. C	12.5	13.0	7.5	11.8
Raleigh, N. C	11.85	12.35	7.5	12.6
Salisbury, N. C	12.15	12.65	7.5	13.0
Charleston, S. C	10.95	11.45	7.5	....
Columbia, S. C	11.8	12.3	7.5	....
Spartanburg, S. C	12.5	13.0	7.5	....

	Mineral Spirits T.W.	V.M.&P. T.W.
Newark, N. J	13	14.5
Baltimore, Md	15.5	....
Washington, D. C	15.5	....

Fuel Oils—T.W.	No. 1	No. 2	No. 3
Atlantic City, N. J	10	9	9
Newark	10	9	9
Annapolis, Md	....	9.25	....
Baltimore	9.8	9	9
Washington, D. C	10.3	9.4	9.4
Norfolk, Va	10	8.8	8.8
Petersburg	10.3	9	....
Richmond	10.3	9	9
Charlotte, N. C	10.6	10.4	....
Hickory, N. C	....	10	....
Raleigh	11.6	10.1	....
Charleston, S. C	....	9	....
Columbia	....	10	....
Spartanburg	....	10.8	....

*Effective Aug. 5, '42 minimum retail resale price of 14.2c posted thru New Jersey.

Discounts:

Esso gasoline—to undivided dealers, 0.5c off dealer t.w.

Kerosine—1c off t.w. price for 25 gals. or more, under contract thru territory (Baltimore city contract not necessary) except no discount in state of New Jersey.

Naphthas—To buyers taking following quantities at one time: Newark, 2c per gal. on 200 gals. or more, less than 200 gals. 0.5c higher price; Baltimore, 2c off on 25 to 100 gals. and 3c on over 100 gals.; Washington, 2c off to contract buyers.

Socony-Vacuum Oil Co., Inc.

Socony Mobilgas (*Regular Grade*)

New York City	Com. Cons. T.W.	Indiv. Dlr. T.W.	Gasoline Taxes
Manhattan & Bronx	10.1	10.6	*5.5
Kings & Queens	10.1	10.6	*5.5
Richmond	9.7	10.2	*5.5
Albany, N. Y	9.9	10.4	5.5
Binghamton, N. Y	11	11.5	5.5
Buffalo	10.2	10.7	5.5
Jamestown, N. Y	10.4	10.9	5.5
Mt. Vernon, N. Y	10.1	10.6	5.5
Plattsburg, N. Y	11	11.5	5.5
Rochester, N. Y	10.8	11.3	5.5
Syracuse, N. Y	10.5	11	5.5
Bridgeport, Conn	10	10.5	4.5
Danbury, Conn	10.5	11	4.5
Hartford, Conn	10.6	11.1	4.5
New Haven, Conn	10	10.5	4.5
Bangor, Me	10.7	11.2	5.5
Portland, Me	10.3	10.8	5.5
Boston, Mass	9.9	10.4	4.5
Concord, N. H	11.4	11.9	5.5
Lancaster, N. H	12	12.5	5.5
Manchester, N. H	11.3	11.8	5.5
Providence, R. I	10	10.5	4.5
Burlington, Vt	10.9	11.4	5.5
Rutland, Vt	11	11.5	5.5

	Mineral Spirits T.W.	V.M.&P. T.W.
Buffalo, N. Y	12.4	13.6
New York City	11	12
Rochester, N. Y	13.2	14.4
Syracuse, N. Y	14	....
Boston, Mass	12	13
Bridgeport, Conn	†16.3	†17.3
Hartford, Conn	†16.3	†17.3
Providence, R. I	13	14

	Kerosine Yard	Kerosine TW	Mobilfuel Diesel TC	Mobilfuel Diesel TW	Mobilheat Fuel Yard	Mobilheat Fuel TW
New York:						
Manhat'n & Bronx	7.5	10.3	....	9.3	7.1	9
Kings & Queens	7.5	10.3	....	9.3	7.1	9
Richmond	7.5	10.3	....	....	7.1	8.8
Albany	7.5	9.8	7	9.3	7	9
Binghamton	8.9	11.2	....	10.7	8.4	10.2
Buffalo	8.6	10.9	8	10.3	8.2	10
Jamestown	8.7	11	....	10.6	8.3	10
Mt. Vernon	7.6	10.3	....	9.4	7.2	9
Plattsburg	8.1	10.4	....	9.9	7.6	9.4
Rochester	8.7	11	7.9	10.2	7.9	9.7
Syracuse	8.5	10.8	7.8	10.1	7.8	9.6
Conn.:						
Bridgeport	7.8	10.3	....	....	7.2	8.8
Danbury	8.2	10.8	....	....	7.5	8.8
Hartford	8.0	10.5	....	9.5	7.2	9
New Haven	7.8	10.3	....	9.3	7	8.9
Maine:						
Bangor	7.9	10.2	7.4	9.7	7.4	9.1
Portland	7.5	10.2	7	9.3	7	9
Mass.:						
Boston	7.8	10.6	6.9	9.2	7.1	9
N. H.:						
Concord	8.4	10.7	....	....	8.2	10
Lancaster	9.5	11.8	....	....	9.2	11
Manchester	8.5	11.1	....	....	7.9	9.7
R. I.:						
Providence	7.6	9.9	6.9	9.2	7.1	8.9
Vermont:						
Burlington	8.1	10.4	7.5	9.8	7.5	9.2
Rutland	8.3	10.6	....	10	7.7	9.5

*Does not include 1% city sales tax applicable to price of gasoline (ex tax).

†In steel barrels.

Discounts: Diesel—On t.w. deliveries, 0.5c for at least 400 gals.; 1c for full tank truck.

Atlantic Refining

Atlantic White Flash Gasoline (*Regular Grade*)

	Commercial T.W.	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
Philadelphia, Pa	10.2	10.7	5.5	12.25
Pittsburgh	10.7	11.2	5.5	12.6
Allentown	10.7	11.2	5.5	12.6
Erie	10.7	11.2	5.5	12.6
Scranton	10.7	11.2	5.5	12.6
Altoona	10.7	11.2	5.5	12.6
Emporium	10.7	11.2	5.5	12.6
Indiana	10.7	11.2	5.5	12.6
Uniontown	10.7	11.2	5.5	12.6
Harrisburg	10.7	11.2	5.5	12.6
Williamsport	10.7	11.2	5.5	12.6
Dover, Del	....	11.2	5.5	12.6
Wilmington, Del	....	10.7	5.5	12.1
Boston, Mass	....	10.9	5.5	....
Springfield, Mass	....	11.8	4.5	....
Worcester, Mass	....	11.5	4.5	....
Fall River, Mass	....	11	4.5	....
Hartford, Conn	....	11.6	4.5	....
New Haven, Conn	....	11	4.5	....
Providence, R. I	....	11	4.5	....
Atlantic City, N. J	....	10.7	4.5	10
Camden, N. J	....	10.7	4.5	10
Trenton, N. J	....	10.7	4.5	10
Annapolis, Md	....	11.05	5.5	10.8
Baltimore, Md	....	10.45	5.5	9.8
Hagerstown, Md	....	11.55	5.5	10.3
Richmond, Va	....	11.25	6.5	12.3
Wilmington, N. C	....	11.55	7.5	11.9
Brunswick, Ga	....	10.4	7.5	‡11.1
Jacksonville, Fla	....	10.4	8.5	12.1

	Mineral Spirits T.W.†	V.M.&P. T.W.†
Philadelphia, Pa	11	12.5
Lancaster, Pa	12	13.5
Pittsburgh, Pa	12.5	13.5

Fuel Oils—T.W.	1	2	3	5	6
Phila., Pa	10.1	9	9	5.76	5.33*
Allentown, Pa	10.6	9.3	9.3	....	....
Wilmington, Del	10.1	9	9	....	....
Springfield, Mass	10.2	9.4	9.4	....	....
Worcester, Mass	10.2	9.3	9.3	....	....
Hartford, Conn	10.5	9	9	....	....

‡Does not include 1c Georgia kerosine tax.

†Mineral Spirits prices also apply to Stoddard Solvent; V.M.&P. prices also apply to Light Cleaners Naphtha.

Discounts:

Gasoline—to undivided dealers, 0.5c off dealer t.w., except Georgia & Florida dealer t.w. and undivided dealer t.w. prices are same.

Kerosine—Thru Penna. & Delaware, 2c off t.w. price on t.w. deliveries of 25 gals. or more at one time.

*Residual fuel 16.0-19.9 gravity.

S. O. Ohio††

***Sohio X-70 Gasoline (*Regular Grade*)**

	Consumer T.W.	**Reselers	Gasoline ‡S.S.	Gasoline Taxes	†Kerosine T.W.
Ohio, Statewide	12	10	13.5	5.5	9.3
Akron	12	9.5	12.5	5.5	9.3
Cincinnati	12	9.5	12.5	5.5	9.3
Cleveland	12	9.5	12.5	5.5	9.3
Columbus	12	9.5	12.5	5.5	9.3
Dayton	12	9.5	12.5	5.5	9.3
Marietta	12	9.5	12.5	5.5	9.3
Portsmouth	12	9.5	12.5	5.5	9.3
Toledo	12	9.5	12.5	5.5	9.3
Youngstown	12	9.5	12.5	5.5	9.3

Aviation Gasoline—Statewide

	Consumer T.W.	Gasoline Taxes
Sohio aviation grade 65 octane, Spec. AN-VV-F-756	14.5	5.5
Esso Ethyl Aviation 73 Oct.	15.5	5.5
Esso Ethyl Aviation 80 Oct.	16.5	5.5
Esso Ethyl Aviation 87 Oct.(a)	17.5	5.5
Esso Ethyl Aviation 91 Oct.	17.5	5.5
Esso Ethyl Aviation 100 Oct.	24.5	5.5

(a) Effective Oct. 15, 1942.

	†Naphtha—T.W. Statewide	Lucas County
S. R. Solvent	13.5	13.5
D. C. Naphtha	14.5	14.25
V.M.&P. Naphtha	14.5	14.25
Varnolene	14.5	14.25
Sohio Solvent	14.5	14.25

Fuel Oils—T.W.	No. 1	No. 2	No. 3	No. 4
Ohio, Statewide	8.3	8.3	7.8	....
Cleveland	10.3	10.3	9.8	7.55

*Renown (third-grade) prices are same as X-70 unless otherwise noted.

**Except authorized agents.

†Kerosine prices are ex 1c state tax. Naphtha prices are ex 1.5c federal & 4c state tax.

‡Prices at company-operated stations.

††Statewide prices are subject to exceptions other than those shown.

Discounts:

Esso aviation—on contract to hangar operators and resellers, 2c off consumer t.w.

Fuel oils—Statewide prices are for t.w. & drum deliveries of 50 gals. or more; prices for deliveries of less than 50 gals. are 0.5c higher. Cleveland Division assumed the state-wide fuel oil tank wagon prices on Nos. 1, 2 and 3 fuel oil, effective May 10. However, the price of 7.55c per gallon on No. 4 fuel oil (full compartment hose dumps only) will remain as heretofore, in Cleveland Division.

Naphthas—to contract consumers off t.w. prices—Statewide: 300 to 999 gals., 0.5c; 1000 to 2499 gals., 0.75c; 2500 to 4999 gals., 1c; 5000 or more gals., 1.5c. Lucas County: Less than 50 gals., tank wagon price, 50 to 249 gals., 0.5c; 250 to 499 gals., 1c; 500 gals. or over, 1.5c.

S. O. Kentucky

Crown Gasoline (*Regular*)
Standard (*Third Grade*)

	†Net Crown	Dealer Standard	Gasoline Taxes	Kerosine T.W.
Covington, Ky	9.5	....	6.5	9.3
Lexington, Ky	10.5	8.5	6.5	9.3
Louisville, Ky	10	....	6.5	8.8
Paducah, Ky	10	8	6.5	8.8
Jackson, Miss	10	9	7.5	*9
Vicksburg, Miss	9.5	....	7.5	*8.5
Birmingham, Ala	10	9	*8.5	9
Mobile, Ala	9	....	*9.5	8.5
Montgomery, Ala	10	9	*9.5	10
Atlanta, Ga	11.4	....	7.5	*12.1
Augusta, Ga	11.4	....	7.5	*11.6
Macon, Ga	11.4	....	7.5	12.1
Savannah, Ga	10.4	....	7.5	11.1
Jacksonville, Fla	10.4	....	8.5	10.1
Miami, Fla	10.4	....	8.5	10.1
Pensacola, Fla	9	8	*9.5	8
Tampa, Fla	10.4	....	8.5	10.1

*Taxes: In tax column are included these city and county gasoline taxes: Mobile, 2c city; Birmingham, 1c city; Montgomery, 1c city and 1c county; Pensacola, 1c city. Georgia and Montgomery, Ala. have 1c kerosine tax, Mississippi 0.5c, not included in above prices.

†Consumer t.w. prices are same as net dealer prices.

S. O. Indiana

Red Crown (*Regular Grade*)
Blue Crown (*Third Grade*)

	Red Crown Cons. T.W.	Red Dealer Prices Red Crown	Blue Crown	Gasoline Taxes	Kerosine T.W.
Chicago, Ill	10.9	8.9	8.4	4.5	10.6
Decatur, Ill	10	8.5	8	4.5	9.8
Joliet, Ill	11.9	9.6	8.5	4.5	10.6

(Continued on next page)

Above prices include these inspection fees on both gasoline and kerosine unless otherwise specified per gallon:
Alabama 1/40c on gasoline, 1/2c on kerosine; Arkansas 1/20c; Florida 1/8c; Illinois 3/100c; Indiana 1/5c in lots of 25 bbls. or less, 2/25c in lots of more than 25 bbls.; Kansas 1/50c; Louisiana 1/32c; Minnesota 7/200c; Missouri 1/50c; Nebraska 3/100c; Nevada, gasoline 1/20c; North Carolina 1/4c; North Dakota 1/20c; Oklahoma 2/25c; South Carolina 1/8c; South Dakota 1/20c; Tennessee 2/5c; and Wisconsin 3/100c.
Kerosine inspection fees only: Iowa 3/50c; Michigan 1/5c per gal.

TANK WAGON PRICES

Commercial or consumer tank car, tank wagon, dealer, and service station prices for gasoline **do not include taxes;** *they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include 1.5c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes where levied are indicated in footnotes. Dealer discounts are shown in footnotes. These prices in effect July 5, 1943 as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

(S. O. Indiana Cont'd)

Red Crown (*Regular Grade*)
Blue Crown (*Third Grade*)

	Red Crown Cons. T.W.	Red Crown Dealer Prices	Blue Crown	Gasoline Taxes	Kerosine T.W.
Peoria, Ill.	11.7	9.2	9.1	4.5	10.4
Indianapolis, Ind.	11.6	9.7	9.6	5.5	*10.1
Evansville, Ind.	11.4	9.9	7.9	5.5	*9.9
South Bend, Ind.	12	10.5	10	5.5	*10.5
Detroit, Mich.	11.4	9.9	9.4	4.5	10
Grand Rapids, Mich.	10.8	9.3	8.8	4.5	9.9
Saginaw, Mich.	11.4	9.9	9.4	4.5	9.9
Green Bay, Wis.	12.2	10.7	10.2	5.5	10.9
Milwaukee, Wis.	12.1	10.6	10.1	5.5	10.8
La Crosse, Wis.	11.9	10.4	9.9	5.5	10.6
Minneapolis-St. Paul	11.9	10.4	9.5	5.5	10.6
Duluth, Minn.	12.2	10.7	10.2	5.5	10.9
Mankato, Minn.	11.9	10.4	9.5	5.5	10.6
Des Moines, Ia.	11.4	9.9	9.4	4.5	*10.1
Mason City, Ia.	11.7	10.2	9.7	4.5	*10.4
St. Louis, Mo.	10.3	8.8	8.6	*4.5	10.1
Kansas City, Mo.	10.4	8.9	7.9	*4.5	9.7
St. Joseph, Mo.	11.2	9.7	8.7	*4.5	9.9
Fargo, N. D.	12.9	11.4	10.5	5.5	11.6
Huron, S. D.	12.3	10.8	10.3	5.5	11
Wichita, Kans.	9.7	8.2	6.5	4.5	8.3

Stanavo Aviation 73 Octane

Chicago, Ill.	15.7	4.5
Milwaukee, Wis.	15.9	5.5
Minneapolis, Minn.	15.7	5.5
St. Louis, Mo.	15.2	*4.5
Kansas City, Mo.	14.8	*4.5
Fargo, N. D.	16.7	*5.5
Huron, S. D.	16.1	5.5

	Oleum Spirits	V.M.&P. Naphtha	Stanisol	*Taxes
(Prices are base prices before discounts)				
Chicago	13.5	13.8	12.8	4.5
Detroit	15.8	15	16.3	4.5
K. C., Mo.	13.3	14.3	13.8	1.5
St. Louis, Mo.	13.7	14.7	13.2	1.5
Milwaukee	14.4	15.4	14.9	5.5
Minneap'lis	14.2	15.2	13.5	5.5

Fuel Oils T.W.
Chicago

	Standard Heater Oil
1-99 gals.	9.3
100-149 gals.	8.3
150 gals. & over	7.8

	Stanolex Fuel Oil No. 1	Stanolex Furnace Oil
1-99 gals.	8.8	8.8
100-149 gals.	7.8	7.8
150-399 gals.	7.8	7.8
400 gals. & over	7.3	7.3

	Stanolex Fuel Oil A	Stanolex Fuel Oil B
1-99 gals.	8.3	8.3
100-399 gals.	7.3	7.3
400-749 gals.	6.3	6.3
750 gals & over	5.55	5.55

	Stanolex Bunker C Fuel Oil
1-399 gals.	6.8
400-999 gals.	5.8
1000 gals. & over	4.8

Other Points	Stanolex Furnace Oil
Indianapolis	
1-99 gals.	9.0
100 gals. & over	8.0
Detroit	
1-99 gals.	8.7
100 gals. & over	7.7
Milwaukee	
1-99 gals.	9.0
100 gals. & over	8.0
Minneapolis	
1-99 gals.	9.1
100 gals. & over	8.1
St. Louis	
1-99 gals.	8.1
100 gals. & over	7.1
Kansas City	
1-99 gals.	8.1
100 gals. & over	7.1

*Taxes: In gasoline tax column are included these city taxes—Kansas City, St. Joseph, and St. Louis, 1c. Iowa kerosine prices are ex 3c state tax. In naphtha tax column are included 1.5c federal tax and state taxes.

State sales, occupation, consumer and use taxes to be added when applicable.

S. O. Nebraska

(*Regular Grade*)

	T.W. Dealer	Gasoline Taxes	Kerosine T.W.
Omaha	11.4 8.9	6.5	10.1
McCook	12.0 9.4	6.5	9.8
Norfolk	11.9 10.4	6.5	10.6
North Platte	12.3 9.9	6.5	11
Scottsbluff	12.4 9.5	6.5	9.8

S. O. Louisiana

Esso Gasoline (*Regular Grade*)

	Consumer Tank Wagon	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
New Orleans, La.	8.75	9.25	8.5	*9
Baton Rouge, La.	8.75	9.25	8.5	*9.5
Alexandria, La.	8.75	9.25	8.5	*9.5
Lafayette, La.	9	9.5	8.5	*9
Lake Charles, La.	9	9.5	8.5	*11
Shreveport, La.	8.5	9	8.5	*8
Knoxville, Tenn.	9.5	10	8.5	12.5
Memphis, Tenn.	8.90	9.40	8.5	10.5
Chattanooga, Tenn.	10.5	11	8.5	11
Nashville, Tenn.	10.5	11	8.5	10
Bristol, Tenn.	10.95	11.45	8.5	13.1
Little Rock, Ark.	9.5	10	8	10

*Louisiana kerosine prices are ex 1c state tax.

Discounts:

Esso Gasoline—To undivided dealers, 0.5c off dealer t.w.

Humble Oil & Refining Co.

Humble Motor Fuel (*Regular Grade*)
Thriftane (*Third Grade*)

	Humble *Tank Wagon	Humble Retail	Thriftane *Tank Wagon	Thriftane Retail	Gasoline Taxes
Dallas, Tex.	7.5	10.5	6.5	8.5	5.5
Ft. Worth, Tex.	6.5	9.5	6	7.5	5.5
Houston, Tex.	8.5	12.5	7.5	10.5	5.5
San Antonio, Tex.	8.5	12.5	7.5	10.5	5.5

	Kerosine *Tank Wagon	Kerosine Retail
Dallas, Tex.	7	11
Ft. Worth, Tex.	7	11
Houston, Tex.	8	11
San Antonio, Tex.		10

73 Oct. Aviation Gasoline	Tank Car
FOB Baytown, Tex.	8.5

*To all classes of dealers & consumers.

The Texas Co.

	Gasoline—Dealer T.W. Fire-Chief (*Regular*)	Indian (*3rd Grade*)	Gasoline Taxes
Dallas, Tex.	7.5	6.5	5.5
Ft. Worth, Tex.	6.5	6.0	5.5
Wichita Falls, Tex.	8.5	7.5	5.5
Amarillo, Tex.	8.5	7.5	5.5
Tyler, Tex.	8.5	7.5	5.5
El Paso, Tex.	11	10.5	5.5
San Angelo, Tex.	8.5	7.5	5.5
Waco, Tex.	8*	7*	5.5
Austin, Tex.	8.5	7.5	5.5
Houston, Tex.	8.5	7.5	5.5
San Antonio, Tex.	8.5	7.5	5.5
Port Arthur, Tex.	8.5	7.5	5.5

*Less 1c temporary allowance to all dealers.

Continental Oil Co.

(N.B. Prices are Continental's "structural" prices. Prices do not reflect temporary reductions made to meet local competition).

	Conoco Bronz-z-z (*Regular*) †Tank Wagon	Demand (*3rd Grade*)	Gasoline Taxes	Kerosine T.W.
Denver, Col.	11	10	5.5	11
Grand Junction, Col.	12	11	5.5	12
Pueblo, Col.	10.5	9.5	5.5	10.5
Casper, Wyo.	11.5	10.5	5.5	12
Cheyenne, Wyo.	11	10	5.5	11.5
Billings, Mont.	12.5	11.5	6.5	12.5
Butte, Mont.	13.5	12.5	6.5	13.5
Great Falls, Mont.	12.5	11.5	6.5	12.5
Helena, Mont.	13	12	6.5	13
Salt Lake City, Utah	13.5	12.5	5.5	14.5
Boise, Ida.	14.1	13.1	6.5	16.5
Twin Falls, Ida.	15.6	14.6	6.5	17
Albuquerque, N. M.	10	9	*7	9.5
Roswell, N. M.	9.5	8.5	*7	9
Santa Fe, N. M.	10.5	9.5	*7.5	10
Ft. Smith, Ark.	9.5	9.25	*7	9.5
Texarkana, Ark.	9	8	*5.5	9
Muskogee, Okla.	9.5	8.5	7	8.5
Oklahoma City, Okla.	9.5	8.5	7	8.5
Tulsa, Okla.	9.5	8.5	7	8.5

*Taxes: In gasoline tax column are included these city taxes—Albuquerque, & Roswell, 0.5c; Santa Fe, 1c. Texas 4c state tax applies within city limits of Texarkana, Ark.; Okla. 5.5c state applies within city limits of Ft. Smith, Ark.

†To consumers & dealers.

S. O. California

Standard Gasoline (*Regular Grade*)
Flight Gasoline (*Third Grade*)

	Standard Posted Net Tank Truck	Standard Posted Retail	Flight Posted Net Tank Truck	Flight Posted Retail	Gasoline Taxes
San Francisco, Cal.	10	14	9	12	4.5
Los Angeles, Cal.	9.5	13.5	8.5	11.5	4.5
Fresno, Cal.	11	15	10	13	4.5
Phoenix, Ariz.	12	16	10	13	6.5
Reno, Nev.	12	16	11	14	5.5
Portland, Ore.	10.5	14.5	9.5	12.5	6.5
Seattle, Wash.	10.5	14.5	9.5	12.5	6.5
Spokane, Wash.	12.5	16.5	11.5	14.5	6.5
Tacoma, Wash.	10.5	14.5	9.5	12.5	6.5

Std. Aviation 73

	Posted Net Tank Truck	Gasoline Taxes	Kerosine Tank Truck
San Francisco, Cal.	12.5	4.5	11.5
Los Angeles, Cal.	12	4.5	10
Fresno, Cal.	13.5	4.5	12.5
Phoenix, Ariz.	14.5	6.5	12.5
Reno, Nev.	14.5	5.5	13.5
Portland, Ore.	13	6.5	13.8
Seattle, Wash.	13	6.5	13.8
Spokane, Wash.	16	6.5	16.8
Tacoma, Wash.	13	6.5	13.8

Resale & Commercial: T.C. deliveries 0.25c per gal. off posted net tank truck.

Commercial: Retail deliveries, and/or tank truck deliveries of less than 40 gals., 4c per gal. above posted net tank truck price for Standard Aviation and Standard Gasoline, and 3c per gal. above posted net tank truck for Flight Gasoline, except single deliveries of less than 40 gals. to Marine trade only, which are billed at posted net tank truck price.

Canada

PRICES ON IMPERIAL OIL, LTD.

Per Imperial Gallon, which is 1.2 U. S. Gallons

3-Star Imperial Gasoline (*Regular Grade*)

	†Gasoline T.W.	*Gasoline Taxes	†Kerosine T.W.
Hamilton, Ont.	17.5	11	18
Toronto, Ont.	17.5	11	18
Brandon, Man.	21	10	23
Winnipeg, Man.	20.5	10	22.5
Regina, Sask.	18	10	20
Saskatoon, Sask.	20.8	10	22.8
Edmonton, Alta.	18.9	10	20.9
Calgary, Alta.	16	10	18
Vancouver, B. C.	15	10	24
Montreal, Que.	17	11	17.5
St. John, N. B.	16.5	13	19
Halifax, N. S.	16.5	13	19

*Includes 3c Federal, and Provincial taxes.

†To divided & undivided dealers.

Above prices include these inspection fees on both gasoline and kerosine unless otherwise specified per gallon:
Alabama 1/40c on gasoline, 1/2c on kerosine; Arkansas 1/20c; Florida 1/8c; Illinois 3/100c; Indiana 1/5c in lots of 25 bbls. or less, 2/25c in lots of more than 25 bbls.; Kansas 1/50c; Louisiana 1/32c; Minnesota 7/20c; Missouri 1/50c; Nebraska 3/100c; Nevada, gasoline 1/20c; North Carolina 1/4c; North Dakota 1/20c; Oklahoma 2/25c; South Carolina 1/8c; South Dakota 1/20c; Tennessee 2/5c; and Wisconsin 3/100c.
Kerosine inspection fees only: Iowa 3/50c; Michigan 1/5c per gal.

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IF YOU CAN'T FIND A USE FOR IT, *Scrap it!*
WAR-OIL EQUIPMENT EXCHANGE

For Sale

FOR SALE by owner 29—8000 gallon Class Three non-coiled tank cars now in clean oil service. Box 251, National Petroleum News, Cleveland, Ohio.

FOR SALE: 3—20,000 gallon vertical tanks, especially good condition; 1—Tandem 5-horsepower explosion proof pump; miscellaneous assortment of valves, pipes, fittings. All equipment on site. Charles A. Robinson, 2120 Locust Street, St. Louis, Missouri.

FOR SALE
Complete oil and gas bulk plant, including pipelines, unloading facilities, warehouse 20' x 35', three 12,500 gallon tanks, electric rotary pump. Located Versailles, Missouri. For particulars, communicate
Leonard Waddell,
1002 Walnut Street,
Kansas City, Mo.

Situations Open

WANTED, REFINERY OPERATORS who have had stillman or supervisory experience in modern oil refineries. Give refining background and complete experience record. Location Houston, Texas. Send reply to Box No. 252 in care of this magazine.

• • • • WANTED • • • •

Major oil company with continent-wide operations and research seeks graduate technical men of the following qualifications:

MECHANICAL ENGINEERS—with petroleum refinery or similar experience. Should be familiar with refinery design, estimating, construction, mechanical equipment, engineering materials, and utilities systems. Process knowledge desired although not essential.

CHEMISTS AND CHEMICAL ENGINEERS interested in research, design, or plant operation. Should have training and experience in refinery or other industrial organizations.

Work not of a temporary nature. In reply state experience, education, age, marital status, draft classification and salary expected, include small snapshot (not returnable). Replies strictly confidential. Applicants now employed at highest skill in war industries not solicited. Box No. 249, National Petroleum News, Cleveland, Ohio.

For Sale

FOR SALE—640 gallon 4 compartment 1941—1½ ton International tank truck actual mileage 43,370—streamlined tank with side compartments for case goods or grease kits. Price $1500.00. Dabrol Products Corporation, 6265 W. 66th Place, Chicago, Illinois.

Seven 21,000 gallon tanks; one 2-compartment 21,000 gallon tank; one 3-compartment 20,000 gallon tank; pipe and valves; one 40,000 gallon elevated water tank 40 ft. high; also tanks from 280 gallons to 12,000 gallons; 3" and 4" Blackmer pump; one 60 horse Kewanee type boiler with oil burner. Baden Equipment & Construction Co., 3303 Goodfellow, St. Louis, Missouri.

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Tulsa, Okla., 904 World Bldg., Telephone, 3-7132.

Los Angeles, 610-A Hillstreet Bldg., Telephone, VAndike 2845.

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About OIL PEOPLE

Thanks . . .

From the Industry

For a Job Well Done in Government Service

TO:

John Downing, assistant director of PAW's Marketing Division, whose resignation was announced by PAW Deputy Davies on July 3. The resignation was effective July 1. Mr. Downing, who has been with PAW since last December on leave of absence from Standard Oil of Kentucky, will again take up his former activities with that company.

"While PAW regrets exceedingly losing Mr. Downing's services," Mr. Davies said, "he came to us originally with the understanding that he would stay only a limited period and that time has now elapsed. He may return to the industry with the knowledge that we consider that he worked not only hard but effectively in dealing with the many difficult problems connected with the wartime distribution of petroleum."

Mr. Downing's work with Kentucky Standard began in 1921. He was special sales manager and member of the board of directors at the time he left to join PAW. He has been closely connected with industry organizational activities, having served as chairman, Florida Petroleum Industries Committee; member of the board, Kentucky Petroleum Industries Committee; director, Kentucky Petroleum Marketers Assn.; chairman, Kentucky Petroleum Scrap Rubber Drive; and chairman, Joint Use of Marketing Facilities Committee for Kentucky.

Latest addition to tarpon fishermen who have concrete evidence of the fish which *didn't* get away is **Brown L. Meece,** Chicago, sales manager of Globe Oil & Refining Co. According to **Pleas O. Hardwick,** Shreveport, who saw the catch made, this tarpon weighed 75 lbs., was 5 ft. 8 in. long, took 1 hr. 5 min. to land. It was caught off Port Aransas, La.

° ° °

G. J. Neuner, vice-president of Panhandle Eastern Pipe Line Co., announces his resignation to resume private practice of law as soon as it is convenient to the management and board of directors. He has been associated with the company for 12 years, serving as counsel and later as vice-president in charge of operations.

After 35 years with the Barnsdall Oil Co., **Edward B. Reeser,** president, will retire about July 15—his 70th birthday. Mr. Reeser started as office boy for the late T. N. Barnsdall, founder of the company, and worked up to the presidency. He served as president of the American Petroleum Institute from 1929 to 1931, and has been active in other oil industry activities. He is a member of Petroleum Industry War Council.

° ° °

The board of directors of the Petroleum Accountants Society have elected **N. J. Allen** president for the coming year. Mr. Allen is a veteran of the oil industry, having been connected with the California Gasoline Co. and, more recently, having served 13 years as secretary of the Lincoln Petroleum Co. in addition to acting as financial adviser for **R. E. Bering,** oil operator. Mr. Allen, at the present time, is also serving the Macco-McKitrick Co. in a financial capacity. This company is engaged in the construction of the Holtville Auxiliary Air Station for the Navy.

Mr. Allen

Other officers elected by the Society for 1943-44 are: **Charles K. Slack,** General Petroleum Corp. of California, 1st vice-president; **S. J. Anderson,** Ring Oil Co., Ltd., 2nd vice-president; and **Alfred F. Hagen,** Shell Oil Co., Inc., secretary-treasurer. **K. D. Vandervort** was elected a new director of the organization.

° ° °

James E. Pew has been appointed assistant director of PAW's Natural Gas and Natural Gasoline Division, succeeding **Paul M. Raigorodsky** who resigned on June 30, **Deputy PAW Davies** announced July 3. Succeeding Mr. Pew as chief of the Natural Gasoline Section of the division is **Charles E. Webber.**

In 1923, Mr. Pew was employed by the United Natural Gas Co., of Bradford, Pa., during 1924 to 1926, he was with the Hope Construction and Refining Co., of Pittsburgh. For 16 years, from 1926 to 1942, Mr. Pew was associated with the Virginian Gasoline and Oil Co., of Charleston, W. Va. He was called to PAW in January, 1942, as a member of the production division.

Mr. Webber was employed by Humble Oil and Refining Co., from 1934 until June 1942, when he joined PAW as assistant to Mr. Pew in the natural gasoline section.

° ° °

Adolph Erney has been named junior materials analyst in the materials division of PAW's District 1 office in New York City. Mr. Erney was formerly a refining engineer in the Linden, N. J., refinery of Cities Service.

Col. W. E. R. Covell, QMC, head of the Army's new petroleum organization, has been nominated to be a brigadier general.

° ° °

Waite Phillips, Tulsa oil man and financier, has been selected general chairman of the Tulsa Community Fund's annual drive. Last year he was one of the leaders in the drive and has long been interested in Tulsa's character building and charitable agencies.

° ° °

Foster B. Parriot, Tulsa, has been elected chairman of the board of directors for Sunray Oil Co. He has been a director since 1937. **C. H. Wright,** as president, will continue to direct Sunray's operations.

° ° °

Sid White, who has charge of purchases for National Refining Co., Cleveland, is back at his desk about an hour a day following a lengthy illness.

° ° °

Maj. George H. Schoenbaum has entered his fourth year with the Army. Ordered to active duty as a Second Lieutenant with the Ordnance Department, July 1, 1940, he has the longest service of any uniformed oil man in Washington. He is now with the Fuels and Lubricants Division, A.S.F., headed by Col. W. E. R. Covell.

° ° °

New chief of the motor fuels section in PAW's marketing division is **A. J. Hocking** (Texaco). He will continue to head up also the joint use of facilities section

° ° °

Oliver H. Knight, who was writing oil transportation news in NPN's Washington Bureau until inducted into the Army recently, is now Private Knight with the 23d Medical Training Regiment, Camp Joseph T. Robinson, Ark.

° ° °

J. R. (Jack) Cunningham has been named assistant general sales manager of the Continental Oil Co., according to **Harry J. Kennedy,** vice-president in charge of marketing. Mr. Cunningham has been with the company 27 years, starting as an office boy and messenger in the general offices at Denver. In May, 1937, he was named assistant manager of sales administration, the job he held at the time of his promotion.

° ° °

Charles M. Linthicum, veteran oil man who was with the Freedom Oil Co. for years and since the war has held various PAW and other jobs, is now with the Office of Defense Transportation at Washington, in the Motor Transport Division, Petroleum Carriers Section, under **S. F. Niness** and **C. Austin Sutherland.**

That Always Missing Boss's Copy.. Who Has It?

"Confound it, Miss Zilch, why is it that every time I want my PLATT'S WAR-OIL DIRECTORY, you sit there and try to convince me that the whole organization is using it?"

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Individual Names of Oil and Government Men with Addresses and Phone Numbers

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War Agency and Oil Organization Names with Addresses and Phone Numbers

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Government War-Oil Agencies
(OFFICIAL AND SEMI-OFFICIAL)

PETROLEUM ADMINISTRATION FOR WAR
District Offices
PETROLEUM INDUSTRY COMMITTEES
OFFICE OF DEFENSE TRANSPORTATION
Regional Offices
District Offices
OFFICE OF PRICE ADMINISTRATION
Regional Offices
District Offices
PETROLEUM INDUSTRY WAR COUNCIL
Members of Council
Committee Members
OFFICE OF RUBBER DIRECTOR
RUBBER RESERVE COMPANY
WAR PRODUCTION BOARD
Field Offices

Other Government War Agencies

ARMY & NAVY MUNITIONS BOARD
BOARD OF ECONOMIC WARFARE
BOARD OF RESEARCH & INVESTIGATION—TRANSPORTATION
DEFENSE PLANT CORPORATION
DEFENSE SUPPLIES CORPORATION
LEND-LEASE ADMINISTRATION
NATIONAL RESOURCES PLANNING BOARD
NATIONAL WAR LABOR BOARD
Regional Offices
OFFICE OF ALIEN PROPERTY CUSTODIAN
OFFICE OF CIVILIAN DEFENSE
OFFICE OF COORDINATOR OF INTER-AMERICAN AFFAIRS
OFFICE OF ECONOMIC STABILIZATION
OFFICE FOR EMERGENCY MANAGEMENT
OFFICE OF SCIENTIFIC RESEARCH & DEVELOPMENT
OFFICE OF WAR INFORMATION
RECONSTRUCTION FINANCE CORPORATION
WAR MANPOWER COMMISSION
WAR SHIPPING ADMINISTRATION

Government Departments

STATE
WAR
NAVY
TREASURY
JUSTICE
INTERIOR
AGRICULTURE
COMMERCE
LABOR
CAPITOL AND CONGRESS
FEDERAL SECURITY AGENCY
FEDERAL TRADE COMMISSION
FEDERAL WORKS AGENCY
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Plus

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ARMY ★ NAVY

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NATIONAL PETROLEUM NEWS

Monthly Technical Section Devoted to

REFINERY MANAGEMENT and PETROLEUM CHEMICAL TECHNOLOGY

JUL 12 1943
TECHNOLOGY DEPT.

Volume 35 | July 7, 1943 | Number 27

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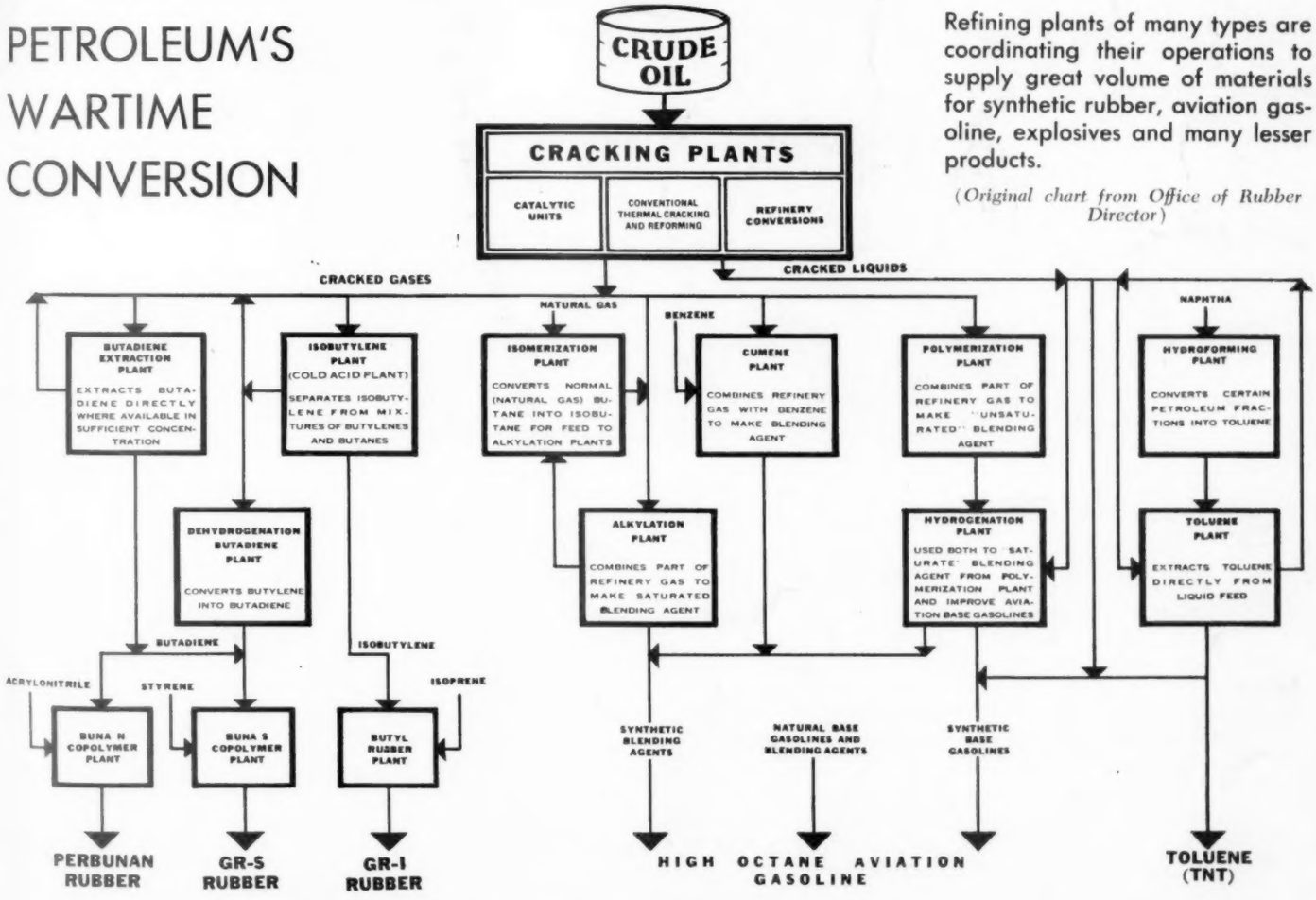
PETROLEUM'S WARTIME CONVERSION

Refining plants of many types are coordinating their operations to supply great volume of materials for synthetic rubber, aviation gasoline, explosives and many lesser products.

(Original chart from Office of Rubber Director)



Directs New Research Project in Synthetic Rubber

Dr. Hugh M. Huffman

Dr. Hugh M. Huffman is head of a new laboratory at the U. S. Bureau of Mines Experiment Station in Bartlesville, Okla. set up to study the thermodynamic properties of hydrocarbons and their derivatives, whose initial work will be in the possibilities for direct conversion of butane to butadiene. This work was requested by the Petroleum Administrator for War. The importance of precise thermodynamic data is recognized in evaluating the efficiency of processes used for the manufacture of aviation gasoline, butadiene and toluene. It is hoped by Dr. Sayers, director of the Bureau of Mines, that the new research project will supply data of practical value to petroleum refiners.

Dr. Huffman has been assistant professor of biochemistry at California Institute of Technology. From 1927 to 1931 he was associate on an American Petroleum Institute research project at Leland Stanford University.

REFINERY MANAGEMENT *and* PETROLEUM CHEMICAL TECHNOLOGY

July 7, 1943
Volume 35
Number 27

A MONTHLY TECHNICAL SECTION OF NATIONAL PETROLEUM NEWS *incorporating International Petroleum Technology*

FUELS and LUBRICANTS For U.S. Army Motorized Ground Forces*

By George A. Round,

Consultant on Fuels and Lubricants, Office of Chief of Ordnance, War Department.

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270

A number of changes have been recommended in the U. S. Army specifications for the so-called all-purpose motor gasoline, which will make possible reducing from three to two the number of seasonal grades required. The modified specifications are presented herewith. It is also proposed to simplify the number of seasonal grades of Diesel fuel for Army requirements.

A new method has been provided by which suppliers of heavy-duty engine oils may show that the oil they propose to offer under the specifications meets the engine test requirement. Changes proposed in gear lubricant specifications are also discussed in this review of fuels and lubricants requirements of the Army Ground Force.

This paper is a revision, including later data on various proposed changes in specifications, of an earlier paper by the same author which was published in the July, 1942, *SAE Journal* of the Society of Automotive Engineers. The author is an automotive engineer with Socony-Vacuum Oil Co., Inc., on leave of absence as Consultant on Fuels and Lubricants, Office of Chief of Ordnance, Technical Division, War Department.

THREE primary considerations dictate the selection of fuels and lubricants for army motorized equipment: first, the requirements of the units; second, the availability of the desired products; and third, the problems of supply. It is difficult to say which of these is the most important; there are continual conflicts between them and practically every selection has been a compromise.

One can never forget the problem of supply at the front. The more simple it can be made, the more certain we can be that every vehicle will be serviced properly. The ideal setup would be one fuel for all engines—one lubricating oil that would take care of both engine and gears—one grease for all chassis lubrication. If oil could be substituted for the grease, so much the better.

Importance of a Simple Program

Unfortunately, it is not possible to simplify the supply problem to reach the ideal just described; the demand for an enormous number of units in the shortest possible time has dictated that every available design, suitable for military use and capable of immediate mass production, should be utilized. In the Ground Force practically every type of engine is used. There are both gasoline and Diesel types, air and water-cooled, with in-line, vee and radial designs ranging in size from tiny single-cylinder air-cooled lighting units to the engines used in the largest tanks.

Babbitt, silver and copper-lead bearings are employed, the latter being used in both combat and transport units, including the 2½-ton truck which is the most numerous of motor transport vehicles. Since these designs differ in their fuel and lubricant requirements, the manufacturers have recommended a wide variety of products for them in civilian service. The Army problem, therefore, has been to reduce these to the absolute minimum consistent with satisfactory results. Some real progress has been made along that line as will be outlined in the following paragraphs.

Fuels

While by far the larger percentage of Army Ground Force engines burn gasoline, there is a substantial number of Diesels in service, especially in construction equipment.

From the supply standpoint, it is highly essential, if not imperative, that all Army ground equipment operate satisfactorily on commercially available fuels. In other words, any

*Presented before the Pittsburgh Section of the Society of Automotive Engineers, May 26, 1943.

Lubrication Problem Involved

The Army's amphibian truck. The boat-like body is mounted on the standard 6-wheel drive chassis which is used for the basic 2½-ton military transport and cargo vehicle. A water-tight steel hull encases the truck frame assembly, below which are mounted the springs, spring brackets and wheels, thus making the unit a motor boat on wheels. Overall length is about 31 ft.; it is approximately 8 ft. wide and 7 ft. high with canvas top down. The unit can be driven through all 6 wheels at 50 miles per hour on highways. In the water it is driven by a rear-mounted propeller and can make better than 6 miles per hour. The axle and propeller shafts pierce the hull through sealed tubes or openings. Steering gear is connected to the rudder, so that normal operation of the wheel guides the vehicle either in water or on land

tactical unit comprising combat and transport units with auxiliary equipment should be able to use fuel from filling stations, bulk plants, or refineries along any route that it travels. It should not be necessary for any such units to depend upon special products laid down along the line of march or in any particular field of operation in the U. S. A. In combat, the use of a single fuel is even more imperative.

Gasoline Requirements

As a war measure, it became necessary immediately after Pearl Harbor, to reduce the octane level of gasoline sold to the public in order to release quantities of stocks which could be used in making aviation gasoline and also to conserve lead. However, this downward trend could not continue indefinitely without coming into conflict with Army Ground Force requirements.

A substantial number of combat vehicles are equipped with aircraft engines and originally required aviation gasoline. During the past year much work has been done to reduce the octane requirements of these units, both in production and by field alterations. However, it is obvious that there would be a fairly definite limit below which it would be impossible to go without seriously imparing the performance of the units. This limit, therefore, has fixed the minimum octane level at 80/A.S.T.M. for gasoline that could be used in all Army vehicles and also serve as a premium fuel for general civilian use.

Motor transport vehicles and auxiliary equipment in general, were designed for use with the regular grades of gasoline distributed prior to the war. No serious difficulties have developed from the moderate reduction in octane level of these fuels which took place last year. However, it is obvious that further reductions might be troublesome. Here again, Army needs have tended to fix the octane level of civilian fuels, the present figure being 72 A.S.T.M.

George A. Round, Consultant on Fuels and Lubricants, Office, Chief of Ordnance, Technical Division, War Department

While all Army equipment would operate satisfactorily on premium grade fuel, it has been considered a desirable economy to conserve the premium fuel and in the U. S. to operate as many vehicles as possible on the lower octane grade. Hence, where transport vehicles alone are operating, the policy has been to use regular grade gasoline. Where combat and transport vehicles are operating together, both regular and premium grade fuels have been supplied if storage facilities were available. For overseas operations, premium grade fuel only is supplied. This eliminates the possibility of using the wrong grade of gasoline under conditions where it might be disastrous.

Some thought has been given to the use of the single premium grade for all Army Ground Force vehicles. This would permit raising the compression of many units and getting greater power and efficiency from them. If these were compelled to operate on lower octane fuel, this could be compensated for by retarding the spark without reducing power below that obtainable with present compressions fixed for the lower octane fuel. So far, however, this plan has not gone beyond the discussion stage.

Gasoline Specifications

Originally, Army gasoline specifications were written around the characteristics of average commercial fuels as distributed seasonably throughout the U. S., and the two grades were designated respectively Motor Fuel (all-purpose) —U. S. Army Specification 2-105A and Motor Fuel—72 octane, U. S. Army Specification No. 2-114.

To date there has been no change in the 72-octane grade and none is contemplated. On the other hand, a number of changes have proven desirable in the all-purpose fuel.

Last summer, a group organized by the Cooperative Fuel Research Committee assisted the Army in conducting tests to determine the octane requirements and vapor lock characteristics of Army transport vehicles, operating in the Southern California desert. Later, a similar group organized with the assistance of the Cooperative Research Committee assisted in carrying on similar tests of combat vehicles. During the past winter, test work was carried on in a cold area to determine the starting characteristics of the many Army Ground Force units.

As a result of this and other test work, a number of changes have been recommended for adoption by the Army. To date, these have not been officially adopted. However, the general nature of the proposed modifications can be mentioned, and the new specification is given in Appendix I. (A condensed specification for the 72-octane grade, which is unchanged from a previous report,[1], is given in Appendix Ia.—Ed.)

In the all-purpose motor fuel specifications, first, the number of seasonal grades has been reduced from 3 to 2, one intended for all summer service and winter use down to zero degrees. The other is a winter gasoline for use primarily in extreme cold at temperatures not to exceed +10 deg. F. To make this possible, the volatility characteristics of the A and C grades have been changed materially and the permissible vapor pressure of the summer (A) grade is reduced from 8 lbs. to 7 lbs.

From a supply standpoint, these changes are highly desirable, as a single grade of fuel can be shipped into most areas for service during practically all seasons. This eliminates the chance of a winter grade being shipped into a tropical area through diversion of tank cars or tankers after they have left the refinery.

Other changes proposed include a confirmation of the limitation of lead content to 3 cc. per gal., the adoption of an oxidation stability requirement to guard against trouble in long time storage as is often required in military operations and an increase in the permissible sulphur content to 0.25%. This last change makes available large supplies of fuel which have never been shown to be detrimental.

The oxidation stability requirement is new and sufficiently severe to require that effective inhibitors against gum formation be used. It could be disastrous if gasoline stored well in advance of an important operation should prove unusable or tie up equipment in combat. Hence, the emphasis on this new requirement.

With these changes, there has been a modification of the territorial layout for the use of the two grades from the A.S.T.M. recommendations previously followed.

Non-Leaded Fuel

In this paper as published last year[1], it was stated that the small demands for non-leaded fuel for field stoves, blow-torches and other units were being taken care of by a filtering unit which removed lead from regular gasoline. Unfortunately, the original design did not prove satisfactory in general use. However, a later one appears practicable.

While stove designs also have been greatly improved in their lead handling characteristics, non-leaded fuel is still highly desirable for them and for torches, etc. until the newer type filter becomes available. There is also a substantial need for white gasoline in running out engines before storage or shipment. This decreases the possibility for cylinder and valve corrosion. To meet these requirements, a specification for this type of fuel is being prepared. A single grade of 65 octane number and summer volatility characteristics is proposed.

Diesel Fuel

The fuel requirements of Diesel engines used by the Army Ground Forces do not differ appreciably from those in civilian service. Hence, the specifications covering Army Diesel fuel were based on those of commercial high

[1] "Fuels and Lubricants procured by the Quartermaster-General for U. S. Army Motorized Ground Forces", By George A Round, *SAE Journal*, July 1942, p. 267.

Trucks play a part in training Air Force students for aerial combat. Regulation bomber turrets, mounted on the trucks, give students at the Army Air Force gunnery school at Tyndall Field, Fla., practice in operating .30 and .50-caliber machine guns. The target is mounted on a driverless vehicle running on a circular track

speed Diesel fuels as distributed to meet various climatic conditions. The essential requirements for "Oil, Fuel, Diesel, for High-Speed Automotive-Type Diesel Engines," the title for U. S. Army Specification No. 2-102B, are given in Appendix 2.

Seasonal Grades

It will be noted that there are 3 seasonal grades A, B and X, grade B being a winter grade for areas not experiencing extremely cold weather. In this respect, the specifications parallel the original gasoline requirements. However, the same reasons that dictated reducing the number of seasonal gasoline grades from 3 to 2 apply also to Diesel fuel. It is intended therefore that there shall be one grade (A), of such volatility and flow characteristics that it will mean practically all normal temperature conditions and a Grade X which will be satisfactory for extreme winter temperature. Only a small quantity of this will be needed for certain special areas, while the other grade can be shipped practically everywhere anytime and be stored or used at any season.

The problem of drawing up the best possible specifications, consistent with availability, is now in the hands of a special sub-committee of the Cooperative Research Council. As soon as its report is received, it will go into Army channels for approval and publication.

Summary of Fuel Set-Up

Reviewing what has been said here about the fuel program, it is obvious that some real progress has been made in fitting fuels to engines and engines to fuels in order to simplify the supply problem. When the work is finished, the fighting forces will have about as simple a fuel program as can be devised to meet the requirements of existing engine designs. All things considered, it does not now appear possible to get satisfactory performance under all the possible variations in atmospheric temperatures with a single fuel of fixed volatility characteristics, desirable as that would be from the supply angle.

Lubricants—Engine Oils

Coming now to the matter of engine oils, after considering the various types of engines used 2 years ago, it was obvious that, if civilian experience were to be accepted as a guide, high-speed Diesels should be lubricated with very stable detergent type oils—in other words, the heavy-duty motor oils that have been developed during the past few years. The same was true for certain high-output carburetor-type engines. Other experiences, both civilian and military, also indicated that any engine equipped with hard alloy bearings should be lubricated with very stable motor oils.

Some argued that all military engines should be redesigned to use non-corrodible bearings; that no engines requiring "special" oils should be employed. But they ignored two things: first, to get high output with minimum weight, high-performance engines must be used. Bearing loads in some of those engines are beyond the safe limit for babbitt. Second, with the time limits set for the announced production goals, there was no time to redesign, and every available engine that was suitable for the service had to be used.

If the supply problem were to be simplified, it was obvious that the only engine oil to be used would be that suitable for the high-speed Diesel—in other words, a "heavy-duty oil". There was abundant civilian experience to indicate that this type of oil could be employed to advantage in any type of ground vehicle engines. Not only was it used extensively for commercial vehicles but, had the war not interfered, it is probable that all the major oil companies would have been marketing oils of that type through filling stations since at least 2 had been doing so before Pearl Harbor. Hence, with all requirements considered, a tentative decision to use only heavy-duty oils was reached during the summer of 1941.

Specifications

Supplies for the Army are customarily bought on the basis of specifications. It was realized early, however, that something better than the conventional specifications for lubricants would be required if the Army was to get what was wanted. Officers of the Ordnance Department and Quartermasters Corps, therefore, invited representatives of the automotive and petroleum industries to a joint meeting in Detroit early in September, 1941, to consider what sort of specifications should be set up.

At that meeting, it was agreed that, to be acceptable for Army Ground Force use, an oil should pass the engine tests required for a Caterpillar Tractor Co. Certificate of Approval and, in addition, successfully complete the General Motors Diesel 500 Hour Test for Approval for Field Test. The latter was considered to be proof of adequate stability and freedom from bearing corrosion tendencies and the former of satisfactory ability to keep pistons and rings free from gum and hard carbon—that is, detergent properties.

Some simple physical test requirements were

Problems of lubrication were none too easy to solve for the "Alligator", the Army's 10-ton amphibian tank designed to travel on land and water, through desert, jungle, swamps and mountain terrain. Built for carrying troops and equipment almost anywhere, it is one of American industry's newest vehicles of war (Photo from Graham-Paige Motors Corp.)

also recommended to define the general characteristics of the desired oils. An important point to note in connection with these requirements was that only 3 grades were called for —SAE 10, 30 and 50. Agreement on this point had been reached some time before as another means of simplifying the problem of supply. Preliminary specifications for these oils were issued immediately and dated Sept. 3, 1941.

Subsequently, agreement was secured from all manufacturers furnishing engines for Ground Force units that oils meeting the above engine and physical tests would satisfy the requirements of their designs. These specifications were adopted officially April 9, 1942. They are shown in Appendix 3 of this paper as originally published.

Reference to these specifications will show that, while the SAE 30 grade must pass both Caterpillar and General Motors Diesel Tests for approval, the SAE 10 grade was required to pass only the Caterpillar Type Tests. The reason for this difference is that no procedure had been set up for testing this light grade in the General Motors Diesel.

It will also be noted that no engine tests were stipulated for the SAE 50 grade, the reason being that it is too heavy for satisfactory use in either the Caterpillar or General Motors Diesel engine. However, it was required that the same additive be used in this grade as in the approved SAE 30 oil.

During the past year there have been a few minor changes in the specifications. The pour points on the 10 and 30 grades have been lowered to −10 deg. F. and 0 deg. F. respectively and a stipulation included for pour point of these 2 grades after dilution, as is required for extreme low temperature service.

Some additional changes have just been made. The first is the inclusion of the 36-hour Chevrolet engine test as an added requirement for all three grades. Second, a new method is specified by which a supplier may show that the oil he proposes to offer under the specification meets the engine test requirement.

Up until recently, an oil has been accepted if it was included on the approved lists of the Caterpillar Tractor Co. and General Motors Corp. as having passed the Caterpillar type tests and the G.M. Diesel 500-Hour test. For the future, any new or changed oils will be required to be tested in a laboratory approved by the Ordnance Department, except that certain tests will be conducted only at Armour Research Foundation, Chicago. An Army designated committee will review the results of the tests and decide whether or not the oil has met the requirements. All oils now on the Army approved list will not be required to be tested again unless a change is made in their composition, either as to mineral stocks or amount or kind of additive used.

The latest specification condensed is shown in Appendix 3.

Availability of Heavy-Duty Oils

When the adoption of these oils was under consideration, there was considerable question whether there would be sufficient quantities available to meet the needs. A survey of the various sources of supply indicated that there would, providing that their use in civilian passenger cars was discontinued. During the past year the demands have increased tremendously and, since all heavy-duty oils contain critical materials which have other uses, it has been necessary to allocate supplies quite rigidly. So far, it has not been necessary to cut off supplies from civilian motor transport services and it is anticipated that new sources of supply will be available shortly. Hence, there is no reason to expect any shortage for Army or essential civilian needs.

Field Experience

To date the results with heavy-duty oils have been quite satisfactory and comparable with those obtained in civilian service. Engines have been notably cleaner, ring and valve gumming are not reported, bearing corrosion troubles have disappeared and, when the stipulated procedure was followed, there was no difficulty in changing from ordinary to heavy-duty oils. There have been minor troubles as might be expected, but none have been of sufficient importance to cause any question regarding the soundness of the program.

There has been somewhat of an educational problem connected with the introduction of these—to many—new type oils. There were fears of trouble due to putting detergent oils into dirty engines but few cases were encountered and these would have been avoided if the changeover instructions given in Training Circular No. 32 had been adhered to.

Some were disturbed about using the 50-grade detergent oil in radial aircraft engines of combat vehicles in place of 60-grade aero oil but there was no trouble with the lighter grade that did not happen with the heavier one or that could not be corrected mechanically.

There are still some old timers—Army and civilian—who are hard to convince that any trouble they have isn't due to the new type oil. They don't understand how it works and close eyes and ears to the satisfactory experience—manufacturer, commercial vehicle operator and Army-Navy—that it works. However, they are a very small minority.

Speaking as an oil man, it is difficult to visualize trying to find anything better to satisfy all the needs of the Army Ground Force Units than the modern "Heavy Duty Oils", or as the Army terms them, "All-Purpose Engine Oils."

Gear Oil Requirements

About 3 years ago, the Army was faced with the problem of deciding whether or not to accept trucks equipped with hypoid gears. On the assurance of the motor manufacturers that there were several adequate sources of supply of lubricants suitable for service in truck hypoid axles, this gear design was accepted.

The gear lubrication problem then involved spiral-bevel and hypoid axles, transmissions in wide variety, transfer cases for 4- or 6-wheel drives, and also steering gears and winches. Some of these could be lubricated with straight mineral oils, some required at least a mild E.P. material, while the hypoid axles demanded a truck-type hypoid lubricant.

Considering the certainty of trouble if either a straight mineral or mild E.P. lubricant were used with hypoid gears and also the need for simplifying the supply problem, it was decided that, with one exception, the mild, truck type, hypoid lubricant would be used for all gears. For transmission, differentials, and final drives of tanks the same type of oil as used in the engine would be employed.

Specifications

As a basis for procurement a Proposed Federal Specification VV-L-761, dated Oct. 1, 1940, was set up which called for 3 viscosity grades—S.A.E. 80, 90 and 140. This specification stipulated the use of very stable mineral oils, meeting certain Navy Specifications and having marked ability to separate from water, to be blended with approved additives. In addition, it was required that the lubricants pass the Chevrolet High Speed and "Bump" tests for load-carrying ability, also an endurance test.

As a further step in simplifying the supply problem for areas where units might be subject to a very wide range in temperatures, this specification was modified by the adoption, in place of the original S.A.E. 140 grade, of a special oil meeting the viscosity requirements of both the S.A.E. 80 and 140 gear oil classification. The specifications for the 3 grades, with the foregoing modifications are given in condensed form in Appendix 4.

Present Gear Lubrication Problems

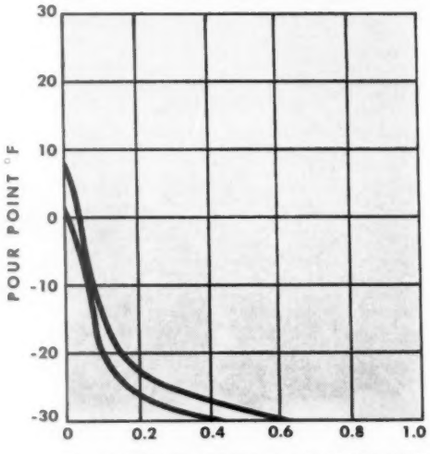
As a result of field experience during the past year, it was learned that any gear oil heavier than SAE 90 was not required, even for desert temperatures. It was also concluded that the emulsion requirement of Federal Specification VV-L-761 was unnecessary and in fact undesirable since, to meet it, oils which would not absorb moisture accumulating in gear cases had to be used. This tended to permit gear and bearing rusting under some conditions.

To meet the latter condition, a revision of Federal Specification VV-L-761 took effect Sept. 1, 1942, the emulsion requirements being eliminated. Since practically all other petroleum products used by the Army Ground Forces are purchased under Army rather than Federal Specifications, it was also decided to issue one covering Universal Gear Oil. This is Ordnance Department, U. S. Army, Tentative Specification AXS-825, dated Nov. 17, 1942. It included grades 80, 90 and 80-90, a special high viscosity index product and was in fact, identical with Federal Specification VV-L-761 in all essential details. It is given in Appendix 4 of this paper.

More recent developments appear to indicate that vehicles can be operated satisfactorily in hot weather with the 80 grade and that heavier oils are unnecessary. If seals are sufficiently effective to hold S.A.E. 90 grade oils, no more leakage occurs with S.A.E. 80 oils. Also due to the greater churning losses with the heavier oils, the actual operating viscosity

How to plan better winter lubricants at lower costs...

HOW SANTOPOUR LOWERS POUR POINT OF TWO TYPICAL MID-CONTINENT OILS



These two curves illustrate how little Santopour is required to effect substantial reductions in pour point. Upper curve represents a Mid-Continent S. A. E. 10-W oil. Lower curve represents a Mid-Continent S. A. E. 20-W oil.

This past winter many refiners and blenders found that by using higher pour point stocks and adding Santopour they could produce low pour point crankcase lubricants . . . with excellent service characteristics . . . at marked savings.

Next winter you may be able to profit from their experience — if you start now.

In most oils only small amounts of Santopour are required for significant reductions in pour point. Since oils vary greatly in their composition and in the amount of wax they contain, however, the exact amount of Santopour required to reduce the pour point of a specific base stock must be determined in the laboratory.

To check now on exactly how little Santopour will be required in your particular oils, simply send us a pint sample of your oils . . . or, if you prefer to make your own tests, write for a sample supply of Santopour today.

Santopour is easily blended with petroleum oils and its addition does not change any property of the oil except to lower its pour point. Lubricants containing Santopour permit: (1) easier engine starting at low temperature and (2) improved pumpability of the cold oil resulting in decreased engine wear.

Right now there is no shortage of Santopour for military and essential civilian crankcase lubricants. By checking now on the effectiveness of Santopour in your oils...then ordering your fall requirements now... you will be ready to meet next winter's heavy demand without delay. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, St. Louis, Missouri.

NOTE—Suppliers of U. S. Army 2-104B oils are required to meet minus 40° F. after dilution with 20% precipitation naptha. Santopour enables you to meet this specification.

MONSANTO CHEMICALS

SERVING INDUSTRY...WHICH SERVES MANKIND

Scout car and field artillery elements of an armored division go into action during field maneuvers in this country

is about the same for both grades. Experience this past winter has also shown that for extremely low temperatures a lighter oil than the present 80 grade is required, the practice of diluting the 80 grade oil with gasoline, kerosine or Diesel fuel being impracticable except as an emergency measure. It may be stated, therefore, that the present trend of development is toward a single gear oil—Grade 80—for all normal summer and winter service down to zero or −10 deg. F., and a special very light grade for use in those areas where winter temperatures may reach 50 or 60 deg. below zero and will not go much above +10 deg. F. or +15 deg. F. As yet, however, this program has not been finalized and the 90 grade is being recommended for summer service above 32 deg. F. Specifications for the special winter oil may be released soon after this paper is presented since shipments into cold areas must be started far ahead of winter weather.

Due to the fact that certain types of E.P. gear lubricants with a satisfactory service record are excluded by the present Federal and Army specifications, a special subcommittee of the Cooperative Research Council has been requested to work out a qualification test based on successful lubrication of gears coupled with laboratory tests. When this work is finished, it is hoped that gear lubricants can be purchased on the basis of actual performance, as are the heavy-duty engine oils.

Chassis Lubrication

Motorized equipment needs as good or better chassis lubricants than required by commercial fleet operations. Army transport vehicles face conditions of dust, mud, and water to a greater extent than do civilian vehicles, and they must function efficiently at arctic or desert temperatures. While at bases there may be adequate lubricating equipment, in the field hand guns may at times have to suffice. There is also the need to reduce the number of grades to the absolute minimum in order to simplify the supply and equipment problems.

In this paper as originally published, it was stated that the problem of grease specifications had been referred to the C.R.C. War Advisory Committee for study, as a result of which Army specifications for 5 grades of grease were set up. These covered winter and summer chassis grades, a wheel bearing grease, a grade for water pumps and a special heavy-duty wheel bearing grease.

Products procured under these specifications have worked well generally, but experience in the field as well as further work by the C.R.C. group assigned to the problem, have shown the need for a number of improvements. In the case of the winter chassis grease, the viscosity of the mineral oil has been reduced and a limit set for this at zero and soda base greases excluded in this grade. A pour test limit has also been introduced. These changes improve pumpability and distribution at low temperatures.

In the case of the wheel bearing grease, the viscosity requirement was modified to assure better low temperature operation.

The specifications as revised are given in Appendix 5. With these, it appears that the Army is assured of getting good products which, if correctly applied in accordance with published recommendations of Ordnance Field Service, will give good results. However, there is a big problem of education in proper lubrication practice.

It has long been the custom of those using oil and grease to regard low-consumption and non-leakage as highly desirable. Also, the usual remedy in case a given grade of oil or grease didn't work right, was to use something heavier. The same opinion has existed in the Army, and perhaps was carried there by civilians working with or going into it. It certainly has been fostered by many oil salesmen. Often, however, the practice of using very heavy products to control leakage has caused trouble. The experience with heavy gear oils has already been cited.

In the case of chassis lubrication, experience has shown that track rolls are better protected by a soft grease which slowly and steadily leaks out past the seals, lubricating them and washing out dirt, dust and water. Also, if a heavy grease is used and the vehicle is shipped into a cold area, it is impossible to displace the heavy material by pumping in light grease. The whole assembly must be taken down and cleaned.

Constant velocity front axle universal joints present a similar problem as do steering gears and propeller shaft universal joints. This has led to the recent adoption by the Army of the policy of requiring manufacturers and Army depots to fill all parts—engines, gears, chassis points—with winter lubricant, regardless of the season. Then, if the unit goes into a cold area, it is ready for service. If it goes to the tropics, heavier lubricants may be used if necessary, but the light products will do no harm.

This emphasizes the constant need and endeavor to work toward single all-purpose types of fuels, oils, greases and also designs which permit their use under all temperature conditions.

Product Recommendations

Correct application of fuels and lubricants is equally as important as quality products. To assure this, the Field Service Division, Office of the Chief of Ordnance, has prepared and distributed to all the using arms of the

service, lubrication charts and guides similar to those widely used in the petroleum industry. They are supplemented by Field Service Bulletins and other forms of instruction on lubrication practice, all of which are intended for use throughout the entire chain of maintenance from driver to base shop, motor pools, ordnance depots and manufacturers of the equipment.

As a part of driver and mechanic training at the various Army schools and training centers, instructions in lubrication and lubricants is given. There are definite maintenance schedules for the various services and in them there is a large factor of safety in comparison with some civilian practices in lubrication.

According to present practice, only one grade of chassis grease is needed at a given season, No. 1 in summer, No. 0 in winter; hence only one chassis grease gun is required. Wheel bearings are hand or machine packed with No. 2 grade, except under extreme summer temperatures No. 3 may be used. Waterpump grease No. 4 is required only for a few units. As previously stated, there is still a tendency for some to use No. 2 or even No. 3 for summer chassis lubrication. The effect on universal joints and track rolls in moderate weather is not too happy so there is still plenty of educational work to be done but the basic program has been completed and is both thoroughly sound and simple. Only ignorance, prejudice, failure to carry out orders or breakdown of supply should cause failures insofar as the lubrication phase is concerned.

Summary

In general, it may be said that a great deal of progress has been made by the Army in getting through improved specifications the most desirable types of products. The emphasis today is on reliable performance rather than low cost. We cannot afford to lose men or battles as a result of poor products obtained through loose specifications.

Specifications for Army Ground Force Fuels & "Lubes"

APPENDIX 1
MOTOR FUEL (ALL-PURPOSE)
U. S. Army Specification No. 2-103B
(April 8, 1943)

E. DETAILED REQUIREMENTS.

E-1. Motor fuel shall be of one grade and two types with automatic provisions for locality and climatic conditions, and shall conform to the following requirements:

	CLASSIFICATION A	C
A.S.T.M. Distillation:		
10% evaporation, °F.	140-158	122 (Max.)
50% evaporation, °F (Max.)	221	203
90% evaporation, °F (Max.)	329	302
Residue, percent, Max.	2	2
Vapor Pressure, psi, Max. (a)	7	12
Octane No., ASTM. Min.	80	80
Gum, mg/100 ml, Max. (b)	7	7
Sulphur, percent, Max.	0.25	0.25
Corrosion	None	None
T.E.L. Content c.c./gal. (Max.)	3	3
Oxidation Stability (Max.)	2 lb. drop in 7½ hr.	2 lb. drop in 7½ hr.

(a) When vapor pressure measurements are made on samples taken at the refinery or from tank cars, barges, or bulk storage, an additional 1 psi in vapor pressure shall be allowed, except that no increase in vapor pressure shall be permitted when the motor fuel is for use in tropical areas (23½° north latitude to 23½° south latitude).

(b) When a finished gasoline contains a non-volatile additive, it shall be permissible to make the gum test on the base stock.

E-2. The color of the fuel shall be red and substantially equal in color intensity to that obtained by the addition of 2 grams of red dye (equivalent to International Color Index No. 258) per 100 U. S. gallons of white gasoline (26 + color).

E-3. The class of motor fuel to be supplied in any locality at any one season of the year shall conform to the following tabulation, and each contractor shall automatically make seasonal modifications in accordance with this tabulation:

TERRITORY	Jan.	Feb.	Mar.	April	May	June
Section 1	C or A	C or A	C or A	A	A	A
Section 2	C or A	C or A	A	A	A	A
Section 3	A	A	A	A	A	A
Section 4	A	A	A	A	A	A

TERRITORY	July	Aug.	Sept.	Oct.	Nov.	Dec.
Section 1	A	A	A	A	A	C or A
Section 2	A	A	A	A	A	A
Section 3	A	A	A	A	A	A
Section 4	A	A	A	A	A	A

Section 1.	Section 2.	Section 3.	Section 4.
Idaho	Colorado	Nebraska	Alabama	Arizona (b)
Iowa	Connecticut	Nevada	Arizona (a)	Florida
Maine	Delaware	New Jersey	Arkansas	Louisiana
Michigan	District of Columbia	New York	California	New Mexico (b)
Minnesota	Ohio	Georgia	Texas (b)
Montana	Illinois	Oregon	Mississippi
New Hampshire	Indiana	Pennsylvania	New Mexico (a)
North Dakota	Kansas	Rhode Island	North Carolina
South Dakota	Kentucky	Utah	Oklahoma
Vermont	Maryland	Virginia	South Carolina
Wisconsin	Massachusetts	Washington	Tennessee
Wyoming	Missouri	West Virginia	Texas (a)

(a) North of 33 deg. latitude.
(b) South of 33 deg. latitude.

A temperature guide for grade A and C where the above zoning does not apply:

A—For mean temperature from +0°F. to extreme heat.
C—For mean temperature from extreme cold to +10°F.

E-4. A tolerance of one week, plus or minus, will be permitted on delivery of the seasonal grades as specified in paragraph E-3.

APPENDIX 1 (a)
MOTOR FUEL-72 OCTANE
U. S. Army Specification No. 2-114
(Condensed)

E. DETAILED REQUIREMENTS.

"E-1. Motor fuel shall be of one type with automatic provisions for locality and climatic conditions and shall conform to the following requirements:

	Classification A	B	C
ASTM Distillation:			
Maximum Temperature			
for 10% evaporation, F.	160	145	130
for 50% evaporation, F.	257	245	235
for 90% evaporation, F.	356	356	356
Residue, max., %	2	2	2
Vapor Pressure, max, psi (a)	8	10	12
Octane No. ASTM, min.	72	72	72
Gum, mg/100 ml, max. (b)	7	7	7
Sulfur max., %	0.25	0.20	0.15
Corrosion	None	None	None"

Requirements (a) vapor pressure measurements and (b) making the gum test on the base stock, are the same as for Motor Fuel All-Purpose.

In the tabulation for seasonal modifications, the geographical sections are the same as for Motor Fuel All-Purpose. The seasonal modifications for Motor Fuel, 72-octane are given below:

Territory	Jan.	Feb.	March	April	May	June
Section 1	C	C	C or B	B	B or A	A
Section 2	C	C or B	C or B	B or A	B or A	A
Section 3	B or C	C or B	B or A	B or A	A	A
Section 4	B	B or A	B or A	A	A	A

Territory	July	Aug.	Sept.	Oct.	Nov.	Dec.
Section 1	A	A	A or B	B	B or C	C
Section 2	A	A	A or B	B	B or C	B or C
Section 3	A	A	A	A or B	B	B or C
Section 4	A	A	A	A or B	A or B	B

The temperature guide for Grades A, B and C, where the zoning does not apply is:

"A—For mean temperature from 50 deg. F. to extreme heat.
"B—For mean temperature from 25 deg. F. to 70 deg. F.
"C—For mean temperature from extreme cold to 45 deg. F.

"A tolerance of one week, plus or minus, is permitted on delivery of the seasonal grades as specified."

APPENDIX 2
OIL, FUEL, DIESEL
For
HIGH-SPEED AUTOMOTIVE-TYPE DIESEL ENGINES
U. S. Army Specification No. 2-102B
(Condensed)

E. DETAILED REQUIREMENTS.

E-1. This fuel shall conform to the following chemical and physical characteristics:

Class	A	B	X
Cetane No., min.	50	47	45
Distillation Test			
90% point max., F.	650	625	600
End point max., F.	700	700	650
Flash point min., F.	140	115	110
Pour point max., F.	0	—20	—40
Cloud point max., F.	+10	—10	—30
Kinematic Viscosity, centistokes at 100 F.	2.11-4.28	1.8-4.28	1.6-4.28
Carbon residue on 10% bottoms, max.	0.15	0.15	0.15
Sulfur, max., %	1.0	1.0	1.0
Water and Sediment	Nil	Nil	Nil
Corrosion	Pass	Pass	Pass

E-2. The class of fuel to be supplied in any locality at any one season of the year shall conform to the following tabulation and, unless otherwise specified, each contractor shall make deliveries in accordance with this tabulation:

Location	All Year	March through November, inclusive	December through February inclusive
Group 1 States (a)	Grade A		
Group 2 States (b)		Grade A	Grade B
Group 3 States (c)		Grade A	Grade X
Territory of Hawaii	Grade A		
Philippine Islands	Grade A		
Canal Zone	Grade A		
Puerto Rico	Grade A		
Alaska	Grade X		
Iceland	Grade X		
Newfoundland	Grade X		

(a) Group 1 states include:
Alabama, Arizona, Arkansas, California, Connecticut, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, New Jersey, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Virginia, Washington, West Virginia.
(b) Group 2 states include:
Idaho, Illinois, Indiana, Iowa, Kansas, Massachusetts, Michigan, Nebraska, Nevada, New Hampshire, New York, Utah, Vermont.
(c) Group 3 states include:
North Dakota, South Dakota, Minnesota, Montana, Wyoming, Colorado, Maine, Wisconsin.

Every barrel of ISO-BUTANE

IS ESSENTIAL FOR

AVIATION GASOLINE

LIQUID PHASE ISOMERIZATION

Success of the "air invasion" depends on unlimited supplies of 100 octane gasoline. No shortage in its components must impede final Victory.

New Liquid Phase Isomerization gives 50-55% yield per pass of iso-butane. This continuous process provides:

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Lowered capital investment
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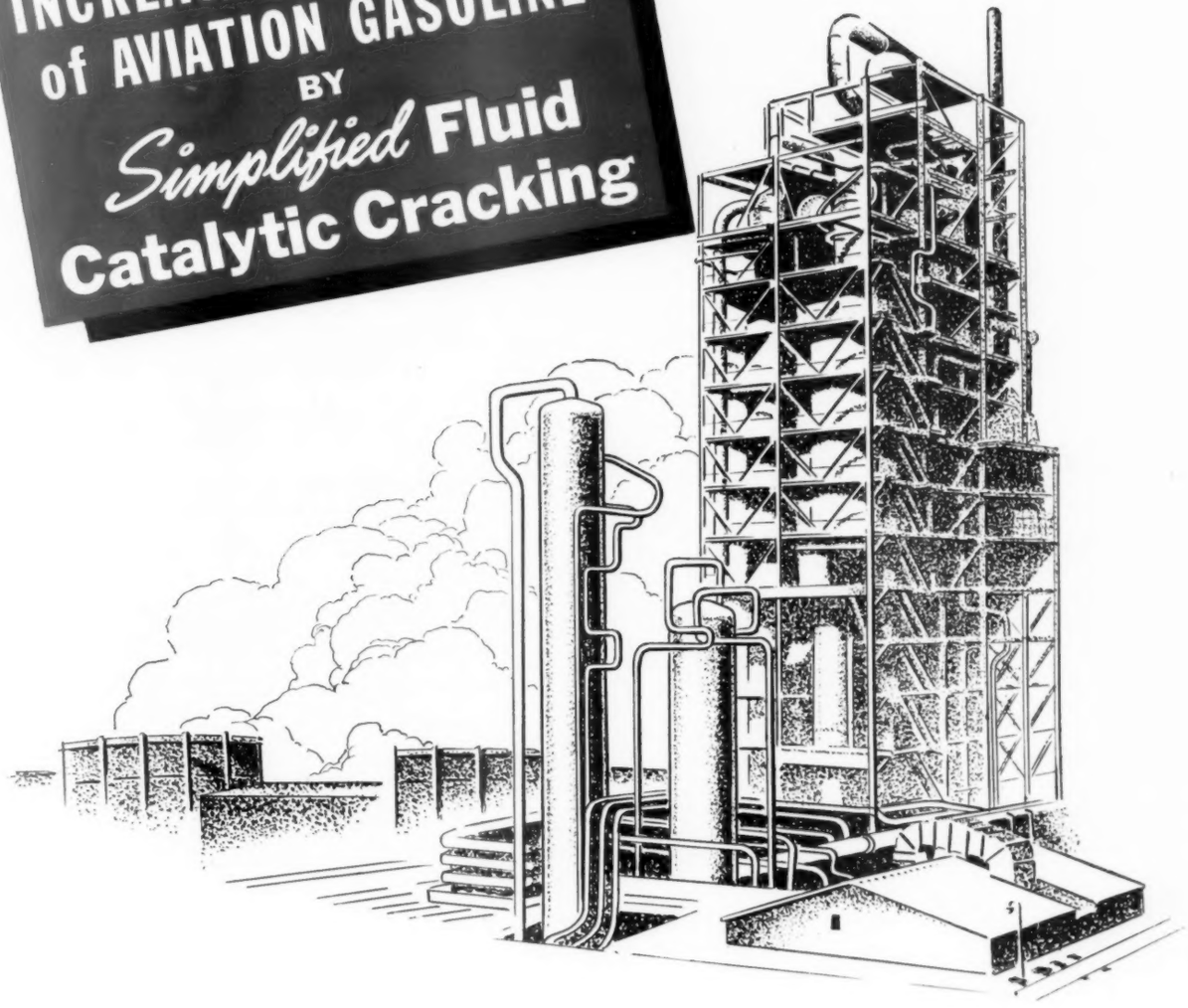
INCREASE PRODUCTION of AVIATION GASOLINE BY *Simplified* Fluid Catalytic Cracking



New design, developed from operating experience with fluid catalytic units, produces the same high yields of quality aviation fuels while sharply reducing capital investment. Steel requirements are more than halved; construction schedule is accelerated.

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Specifications for Army Ground Force Fuels & "Lubes"

APPENDIX 3
OIL, ENGINE
U. S. Army Specification No. 2-104B
Revision May 6, 1943
(Condensed)

B. GRADES.

B-1. Engine oil shall be of three viscosity grades designated as SAE 10, SAE 30 and SAE 50.

C. MATERIAL AND WORKMANSHIP.

C-1. Engine oil shall be a refined petroleum product with or without additive agents.

D. GENERAL REQUIREMENTS.

D-1. Engine oil shall be non-corrosive to bearings and engine parts, shall not cause or permit piston ring sticking or clogging of oil channels and shall minimize cylinder and ring wear. This engine oil shall provide satisfactory lubrication of high speed, automotive type gasoline, Diesel, or spark ignition fuel engines when operated under all conditions of service. Additive agents, if used, shall not appreciably increase the tendency of the base oil to foam.

D-2. Additive agents if used, shall remain uniformly distributed throughout the oil at all temperatures above the pour point up to 250° F. If the oil is cooled below its pour point, it shall regain its homogeneity on standing at a temperature of not more than 10° F. above the pour point of the oil.

E. DETAIL REQUIREMENTS.

E-1. **Qualification.** Engine oils furnished under this specification shall be of a grade or grades which have been tested and found suitable for the purpose intended as determined by the "Qualification" tests in section F (see paragraph H-1).

E-2. Engine oils covered by this specification shall be in accordance with Table I.

TABLE I

Test	Test Limits — Grade SAE 10	Grade SAE 30	Grade SAE 50
Viscosity, Saybolt universal			
Seconds at 130° F.	90 to less than 120	185 to less than 255	
Seconds at 210° F.			95 to less than 105
Viscosity Index, minimum	85	55	75
Pour Point, °F., maximum	minus 10	0	15
Pour Point after dilution with 20 per cent precipitation			
Naphtha, °F., maximum	minus 40	minus 40	
Flash Point, °F., minimum	360	390	400

E-3. **Flash Point.** The minimum flash point of Grade SAE 50 before the addition of any additive shall be 450° F.

E-4. **Control Limits.** For purposes of product identification, the bidder shall state in his bid the suitable control limits of the oil he proposes to furnish, as regards the following:

Gravity, API
Carbon Residue, per cent
Sulphur, per cent
Phosphorus, per cent
Chlorine, per cent
Ash, per cent
Components of Ash, per cent, and such other tests as he may consider desirable for identification purposes.

F. METHODS OF SAMPLING, INSPECTION AND TESTS.

F-3. **Qualification tests.** All engine oil procured under this specification shall be tested for qualification as follows:

F-3a. Unless otherwise specified, the qualification tests shall be made in accordance with Table III (see paragraph H-1):

TABLE III

Required when the finished engine oil uses an additive not previously used in an Engine Oil qualified by the Ordnance Department.	Required when the finished engine oil uses an additive previously used in an Engine Oil qualified by the Ordnance Department.
SAE 10 Grade	**SAE 10 Grade**
1. CRC-Designation-L-4-243	1. CRC-Designation-L-4-243
2. CRC-Designation-L-1-243	2. CRC-Designation-L-1-243
3. CRC-Designation-L-2-243	3. CRC-Designation-L-2-243
4. CRC-Designation-L-3-243	
SAE 30 Grade	**SAE 30 Grade**
1. CRC-Designation-L-5-243	1. CRC-Designation-L-4-243
2. CRC-Designation-L-4-243	2. CRC-Designation-L-1-243
3. CRC-Designation-L-1-243	3. CRC-Designation-L-2-243
4. CRC-Designation-L-2-243	
5. CRC-Designation-L-3-243	
SAE 50 Grade	**SAE 50 Grade**
1. CRC-Designation-L-4-243	1. CRC-Designation-L-4-243

NOTE: CRC Designation L-4-243 is essentially the 36-hour Chevrolet engine test. CRC Designation L-1-243 is essentially the 480-hour single cylinder Caterpillar Diesel engine endurance test. CRC Designation L-2-243 is essentially the single cylinder Caterpillar Diesel engine "Scratch" test. CRC Designation L-3-243 is essentially the 4 cylinder Caterpillar Diesel 120-hour stability and bearing corrosion test. CRC Designation L-5 is essentially the GMC Diesel 500-hour test.

APPENDIX 4
LUBRICANT; GEAR, UNIVERSAL (Hypoid and Other Types)
Ordnance Department, U. S. Army
Tentative Specification (Condensed)

*AXS-825
Nov. 17, 1942

C. MATERIAL AND WORKMANSHIP

C-1. Universal gear lubricant shall consist of a mixture of well-refined mineral oil and a lead-carrying additive containing sulphur and chlorine, with or without the admixture of other additives.

C-2. Universal gear lubricant shall be satisfactory for the lubrication of all automotive gear units (hypoid or other types), all heavy duty industrial type enclosed gear units, steering columns, and fluid lubricated universal joints of automotive equipment, where the sustained operating temperatures of the lubricant are 250° F. or lower.

D. GENERAL REQUIREMENTS

D-1. Universal gear lubricant shall be homogeneous liquids, free from sediment and suspended matter, and shall remain without turbidity at any temperature in the operating range up to 250° F.

D-2. Universal gear lubricants supplied by different, or the same, manufacturers shall meet the detailed requirements of this specification when mixed in any proportions.

D-3. Universal gear lubricants shall contain only those additives in fixed percentages which have been subject to type tests for solubility, emulsion, effect of rate of shear, and endurance by the National Bureau of Standards or a laboratory approved by them, with the sole exception that materials whose only function is to lower the pour point will not be considered as additives for purposes of this specification.

E. DETAIL REQUIREMENTS

E-1. Universal gear lubricants shall conform to the following requirements:

Test	Test Limits — 80	90	80-90
Viscosity, S.U. sec. at 210° F.	55-65	80-90	80-90
Viscosity Index, Dean & Davis, min.	85	85	110
Channel test, °F. max.	—30	0	—30
Load-carrying capacity, lb., min.			
Before heating, 1000 rpm	300	325	325
After heating, 500 rpm	400	400	400
Shock test	pass	pass	pass
Stability test (100 hr. at 300° F.)			
Visc. increase, per cent, max.	25	25	25
Insol. material, per cent, max.	0.5	0.5	0.5
Evap. loss, per cent, max.	10	10	10
Corrosion tests			
1 hr. at 212° F., copper strip	Negative	Negative	Negative
1 hr. at 300° F., copper strip	Positive	Positive	Positive
24 hrs. at 200° F., steel strip, gm., max.	0.01	0.01	0.01
Foaming test, ml, max.	150	150	150
Turbidity	none	none	none

*The technical requirements of this specification conform in all respects with the requirements of the draft dated September 1, 1942 of proposed Federal Specification VV-L-761.

APPENDIX 5
CONDENSED SUMMARY OF ARMY SPECIFICATIONS FOR GREASES
Nov. 30, 1942

Detail Characteristics	Grade No. 0	1	2	Water Pump	Heavy-Duty Wheel Bearing
Army Specification No.	2-106	2-107	2-108	2-109	2-110
Worked Penetration at 77° F.	355-385	310-340	265-295	175-205	220-250
Oil Content, min., %	90.0	85.0	82.0	65.0	70.0
Water Content, max., %	1.5	2.0	1.5	2.5	Trace
Ash as Sulphates, max., %	3.5	3.5	6.0	8.0	7.5
Free Alkali (as NaOH), max., %	0.2	0.2	0.5	0.2	0.5
Insoluble Matter, max., %	0.10	0.10	0.10	0.10	0.10
*Free Fatty Acids (as oleic), max., %	0.30	0.30	0.30	.	0.3
Dropping Point, min., F.	.	.	250	210	300
Corrosion	Nil	Nil	Nil	Nil	Nil
Mineral Oil					
Viscosity at 0° F., max., sec.	75,000	.	.	.	.
Viscosity at 100° F., min., sec.	275	750	.	100	.
Viscosity at 100° F., max., sec.	325	.	.	.	.
Viscosity at 210° F., min., sec.	.	.	75	.	75
Viscosity at 210° F., max., sec.	.	.	100	.	.
Pour Point, max., F.	—15	.	25	.	.
Flash Point, min., F.	350	350	350	315	350
Soap, Type of	Note 1	Note 2	Note 3	Note 4	Note 5
Fillers	None	None	None	None	None

*Omit determination if aluminum soap is present.

Note 1—Base shall be a calcium and/or aluminum soap of one or more of the higher fatty acids.
Note 2—Base shall be a sodium and/or calcium and/or aluminum soap of one or more of the higher fatty acids.
Note 3—Base shall be a sodium and/or calcium soap of one or more of the higher fatty acids.
Note 4—Base shall be a calcium soap of one or more of the higher fatty acids.
Note 5—Base shall be a sodium and/or calcium and/or barium soap of one or more of the higher fatty acids.

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The Use of Alternate Steels is Provided In 1942 Pressure Vessel Code Addenda

Changes which affect both design and materials for towers, reactors, and similar equipment and their fittings have been made in the 1942 Addenda to the A.P.I.-A.S.M.E. Code for Unfired Pressure Vessels for Petroleum Liquids and Gases. In some instances these provide for alternate steels to replace those formerly used to withstand high temperatures and pressures, but now on the wartime critical list. These revisions are the work of committees of engineers representing the American Petroleum Institute and the American Society of Mechanical Engineers. The code provides for safe practice in the design, construction, inspection and repair of this type of equipment.

The accompanying articles, of which this is the first, are presented to acquaint refinery executives and operators with the significance of the recent revisions in the code, which designers and engineers will follow in the planning and construction of new refining units.

By E. F. Brummerstedt*

Part 1 of Comment on Revisions

Introduction

The following comments on the 1942 Addenda to the A.P.I.—A.S.M.E. Code for Unfired Pressure Vessels are presented for the purpose of calling attention to the revisions and indicating their possible effect on refinery vessel design. The views expressed are entirely the author's and do not in any way reflect the opinions of the members of the A.P.I.—A.S.M.E. Code Committee who drew up the revisions.

The views presented below are in numerical order corresponding to their reference paragraphs in the Addenda. Minor changes are not included.

Revisions In Material Specifications

The reference paragraphs W-201a in the 1942 Addenda read as follows:

"*W-201a Delete references to A.S.T.M. A149 and A150.*

Add the Following:

"*A.S.T.M. A212 Specifications for High-Tensile Strength Carbon-Silicon Steel Plates for Boilers and Other Pressure Vessels (Plates 4½ In. and Under in Thickness).*

"*A.S.T.M. A225 Specifications for Manganese-Vanadium Steel Plates for Boilers and Other Pressure Vessels (Grade A).*

"*1. When this material is used, the radiographing and stress-relieving requirements shall be in accordance with W-318.1 b, and for the present the use of the material shall be limited to operating temperatures of 750 deg. F. or less.*

"*W-201a Add footnote reference[2] after A30, A70, A89 and A201, the footnote to read:*

"*[2] It is the opinion of the committee that plates not over ¾ in. in thickness conforming to these specifications may be used during the emergency, with the bend-test requirements modified to meet those for universal mill plate in Par. 9 of A.S.T.M. Specifications A70.*"

A.S.T.M. A149 and A150 specifications have been combined into A-212 for plates up to 4½ in. thick. This change dates back to 1940 and is probably well known throughout the industry. For those who do not have a copy of the large volume of A.S.T.M. specifications for metals, reference is made to Sect. II of the A.S.M.E. Boiler Code comprising specifications for materials. A-212 specification is identical with A.S.M.E. S-55.

A-212 high tensile steels are preferably used in pressure vessels, operating under high pressure not above 750 deg. F. As noted in Fig. 1 of the Code, creep test data for high tensile steels do not indicate a proportionately greater strength above 750 deg. F. than ordinary carbon steel. The use of A212 high tensile steel is especially recommended for those vessels whose thickness would be greater than 2 in. if ordinary A-70 steel were used at temperatures not exceeding 750 deg. F. This recommendation is based partly on the normalizing and gauge extras charged by the mills, and partly on the greater difficulty of fabricating vessels of plates in excess of 2 in.

A-225 specification manganese-vanadium steel is under the same temperature limitation as A-212, for the same reason. It is a comparatively recent specification, still listed as tentative. Because of its considerably higher cost than A-212, it has not been extensively used in the petroleum industry. Radiographing and stress relieving requirements for A-225, in accordance with W-318.1b, are identical with A212 requirements.

For temperatures above 750 deg. F. and fairly high pressures, the use of A-204 carbon-molybdenum steel is recommended because of higher allowable working stresses as indicated on Table 1A under W-201 of the 1940 Addenda to the A.P.I.—A.S.M.E. Code. A special welding procedure, including preheating, is required for this material, however.

The second footnote under W-201a regarding the use of A-30, A-70, A-89 and A-201 plates up to ¾ in. thick during the emergency, with the bend test requirements modified to meet those for universal mill plate in A-70 specification, is apparently a concession toward less rigid bend test requirements for the thinner plates, and should reduce the percentage of rejections for steel plates of these specifications.

Reference paragraph W-201b in the 1942 Addenda reads:

"*W-201b Revise first sentence as follows:*

"*The use of A.S.T.M. Specifications A7, A10, A78, and A113 is limited to plates not over ¾ in. in thickness, and to temperatures not above 750 F, except that these limitations do not apply to flat cover plates on which no strength welding is applied.*"

This revision obviously will result in a greater use of the lower grade tank and structural steels for vessels whose thicknesses do not exceed ¾ in., with temperatures not exceeding 750 deg. F. This concession has resulted in fabricators being able to obtain plates from stock or warehouses and effecting speedy deliveries on smaller vessels, and the approval for the use of cover plates of these steels, regardless of thickness, has resulted in many last minute substitutions where A-70 plate was not available, and thus avoided delivery delays.

This revision has the hearty approval of many an expediter and production engineer, who was thus enabled to ship a certain refinery vessel on schedule, without sacrificing the code stamp on the vessel.

W-204 Castings. This expanded specification for approved use of different casting materials for nozzles, reinforcements, cover plates, detachable heads, etc., introduces the use of 4 new casting specifications.

A.S.T.M. A157 alloy castings cover a wide

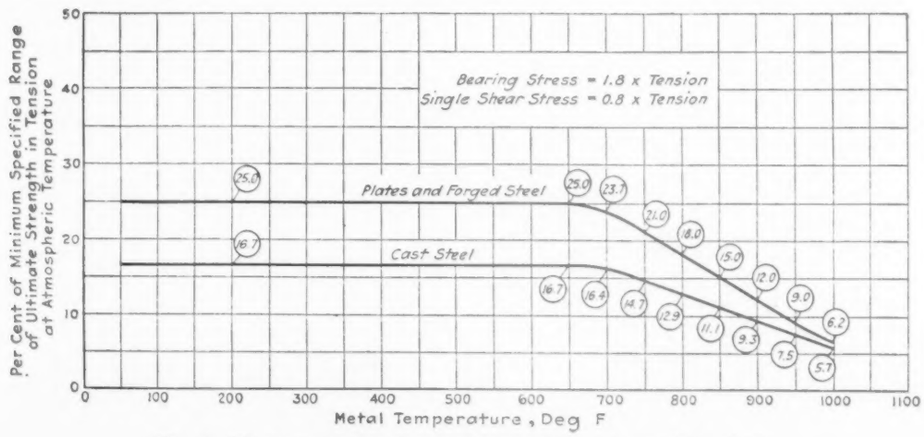

Fig. 1—Maximum allowable working stresses for carbon steel (From A.P.I.—A.S.M.E. Code for Unfired Pressure Vessels)

*Petroleum Refinery Division, Foster Wheeler Corp., New York.

range of alloys from carbon molybdenum (Grade C1) to 18-8 stainless steel (Grade C9). The latter is used only for the most severe corrosive conditions. A.S.T.M. A215, A216, and A217 specifications represent castings recognized as readily weldable and hence suitable for attachment to vessels as nozzles, manholes, support brackets, etc. Many engineers have been reluctant to specify castings for pressure parts, and their use was generally limited to unusual cases of availability, cost reduction, or particular adaptability for a special service.

It is to be noted, however, that castings are given the same rating as forgings in the new ASA War Standard giving revised Pressure-Temperature Ratings for Steel Pipe Flanges, Flanged Fittings, and Valves, approved Jan. 26, 1943. These higher ratings are based on a reduced safety factor, not less than 4, however, and a design factor of 90% for both forgings and castings. This casting factor, presumably based on improved casting and inspection procedures, is more optimistic than the 70% given in the revised Table U-2 of Sect. VIII of the A.S.M.E. Code and the 67% given in Fig. 1 of the A.P.I.—A.S.M.E. Code. (The latter is for temperatures below 650 deg. F.; above that temperature the factor increases to 92% at 1000 deg. F.)

These new ratings should result in an increased use of castings especially in view of the difficulty of obtaining forgings. This will help to by-pass the forging bottleneck and eventually to remove it. The casting materials particularly specified in this new standard are A.S.T.M. A95 and A216 Grades WCA and WCB or equivalent carbon steel castings, and A.S.T.M. A157 Grade C1 and A217 Grades WC1 and WC2 carbon-molybdenum steel castings.

Bolting Material

W-205a Bolting Material. The limits of 450 deg. F. temperature and/or 160 lbs. per sq. in. pressure for the approved use of carbon steel bolts have not been changed. The specifications for alloy steel bolts above those limits have been greatly expanded to enable the designer and production engineer to pick out the proper bolting material which is most easily obtainable. Specifically, the revisions are as follows:

(1) *"Alloy steel bolts of A.S.T.M. A96, Classes A, B, and C are now aproved up to 50 deg. F."*

Previously Class A (90,000—95,000 lbs. per sq. in. tensile strength, depending on diameter) had not been allowed at all. Class B (100,000—105,000 lbs. per sq. in. tensile strength) and Class C (110,000—125,000 lbs. per sq. in.) only, had been approved for temperatures up to 1000 deg. F. Their use at these higher temperatures had never been commonly recommended, however; engineers usually specified a higher alloy of definite composition instead of relying on the indefinite chemical analysis mentioned in the scope of this particular specification.

(2) *"Medium-carbon steel of S.A.E. 1000 series, with silicon content of 0.10% minimum, heat-treated to meet the requirements of A.S.T.M. A96, Class A, is approved up to 850 deg. F."*

The inclusion of this specification under allowable bolting material is in order with the general policy of conservation of critical materials, by requiring only a minimum of silicon and a small percentage of manganese (under 1%) instead of either chrome, nickel or vanadium alloy content.

(3) *"Manganese steel of S.A.E. 1300 series or equal, with a maximum manganese content of 1.90%, heat-treated to meet the requirements of A.S.T.M. Specifications A-96, Class B, is approved up to 900 deg. F."*

The same comments apply to this revision as to (2) above, except that the manganese content is higher.

(4) *"Chromium-molybdenum steels of A.S.T.M. A193, Grade B7 or equal, up to 1000 deg. F., or Grade B7a, up to 1100 deg. F., are approved."*

A193 Grade B7 is an alloy containing 0.15%—0.25% nickel and 0.80%—1.10% chrome, and 0.15%—0.25% molybdenum, in order to resist creep at higher temperatures. Grade B7a contains a little more molybdenum (0.45%—0.65%) for greater strength at the higher temperatures. Both of these materials have been extensively specified for high temperatures following the recommendation in Taylor Forge's "Modern Flange Design", and their inclusion in the Addenda is in recognition of this fact.

(5) *"The following National Emergency steels are acceptable and may be used at the same stresses and up to the same temperatures as permitted for A.S.T.M. A193, Grades B7 and B7a:*

B7	*B7a*
NE 8339	*NE* 8547
NE 8442	*NE* 8949"
NE 8447	
NE 8739	
NE 8744	

Reference to the chemical contents of the above steels indicates that the first 3 steels under B7 contain no nickel or chromium, but have a higher manganese and molybdenum content to give essentially the same high temperature strength. (*See Table* 2). These NE steels were set up primarily to conserve critical alloys, i.e., nickel and chrome, by substituting more easily obtainable alloys i.e., manganese and molybdenum in their chemical analysis. NE 8739 and NE 8744 are intermediate specifications containing some nickel and chrome (0.40%—0.60%) but less manganese and molybdenum. NE 8547 contains no nickel but 0.40%—0.60% molybdenum for high temperature strength and NE 8949 contains 0.40%—0.60% chrome and nickel, 0.30%—0.40% molybdenum to give similar properties. All the above NE steels also contain 0.20%—0.35% silicon.

In general the expanded bolting material specification saves the oil and contracting companies a lot of time and correspondence with fabricators regarding allowable substitutions for bolting material. Having a rather wide list of materials to choose from, the fabricators soon determine the relative availability of these materials, and the acceptance of all these steels by the Code Committee almost automatically insures acceptance by the customer, who is concerned primarily with obtaining a code stamp, based on the knowledge that the Code Committee would not accept unsatisfactory substitutions.

Since alloy bolts have quite often been bottlenecks in vessel deliveries the Code Committees performed a great service for the petroleum industry by accepting this wide range of alloy bolting material as satisfactory for pressure vessel design and construction.

(Part II of this series, covering changes in design specifications W-310 thru W-335a will be presented next month.)

Table 1A Stresses for Carbon-Molybdenum Steels†
(Lb. per Sq. In.)
(Values for intermediate temperatures may be obtained by interpolation)

A.S.T.M. Spec.	Grade	For metal temperatures not exceeding deg F: Up to 750	800	850	900	950	1000
PLATE							
A 204	A	16250	15625	14375	12500	10000	6250
A 204	B	17500	16875	15000	12750	10000	6250
A 204	C	18750	18000	15875	13000	10000	6250
TUBES							
A 206	P1	13750	13440	13125	12500	10000	6250
A 209	T1	13750	13440	13125	12500	10000	5500*
A 209	T1a	15000	14375	13750	12500	10000	5500*
FORGED FLANGES AND FITTINGS							
A 182	F1	17500	16875	15000	12750	10000	6250

†From the 1940 Addenda to the API-ASME Code for Unfired Pressure Vessels
*6250 may be used if grain-size requirements of A 206-39 are specified.
Note: When other than plain carbon steels are used the stress-relief treatment and any preheating necessary shall be such as to secure the required test results.

Table 2—Chemical Composition of NE Steels Acceptable for Bolting Material for Pressure Vessels as Alternate for Nickel and Chromium Alloy Constructional Steels.

Des.	Carbon	Mang.	Moly	Nickel	Chromium
FOR GRADE B7					
NE 8339	0.35/0.42	1.30/1.60	0.20/0.30	.....	.....
NE 8442	0.38/0.45	1.30/1.60	0.30/0.40	.....	.....
NE 8447	0.43/0.50	1.30/1.60	0.30/0.40	.....	.....
NE 8739	0.35/0.42	0.75/1.00	0.20/0.30	0.40/0.60	0.40/0.60
NE 8744	0.40/0.47	0.75/1.00	0.20/0.30	0.40/0.60	0.40/0.60
FOR GRADE B7a					
NE 8547	0.43/0.50	1.30/1.60	0.40/0.60	.....	.....
NE 8949	0.45/0.52	1.00/1.30	0.30/0.40	0.40/0.60	0.40/0.60

NOTE. The following additional element specifications apply to all the basic open hearth steel shown above: Phosphorus 0.040% max.; Sulfur 0.040% max.; Silicon 0.20/0.35%.

'COLLOIDAL' FUEL Substituted for Oil Fuel[1]

By J. F. Barkley[2], L. R. Burdick[3], and A. B. Hersberger[4]

Conversion of oil-fired boilers to "colloidal" fuel firing is shown to be possible without material change in average boiler construction, and the result permits approximately the same boiler efficiency as is developed with "normal" fuel. Results are reported on operation of a typical boiler installation during cooperative tests conducted by the Bureau of Mines and the Atlantic Refining Co. Fuel used contained 40% pulverized high-volatile bituminous coal suspended in Bunker "C" fuel oil.

Problems encountered and discussed include: increased suctions, pressures and loadings on pumps with possible decreased capacities; abrasiveness of fuel; settling out of coal from the mixture; and ash deposition in the furnace. Question of comparative costs is considered briefly without reaching positive conclusions.

THE shortage of fuel oil caused by the war is forcing oil-burning boiler plants to use coal. The cost of installing coal-burning equipment is frequently quite high. Operators of a number of such plants are giving much consideration to the emergency use in present equipment of mixtures of pulverized coal and fuel oil, popularly termed "colloidal fuel", a substitution that would save about one-third the oil.

Involved in this decision are questions as to operating problems, the procurement of the fuel and the costs.

To the oil-burning operator, used to the relative ease of handling and burning fuel oil, adding pulverized coal to oil is something of the nature of adding a contaminant. New operating problems, to be solved by properly organized operating routine, arise from the changed characteristics of the fuel. Colloidal fuel is about 10% heavier in weight per unit volume than oil; it is about 7 or 8 times as viscous; it requires more power for pumping and pump capacities are decreased; it is much more abrasive; if the coal does not stay in suspension, pastelike accumulations occur in various parts of the equipment such as tanks, heaters, and valves; the ash from the coal in the mixture is set free in the furnace.

To obtain information on the operating problems involved, the Bureau of Mines in cooperation with the Atlantic Refining Co. ran about a month's operating test on a colloidal fuel at one of the Atlantic company boiler plants at Philadelphia. The test was run as part of the regular plant steam production with the usual company operators. The fuel used was a mixture of 40% pulverized bituminous coal and 60% No. 6 (Bunker C) fuel oil, no "fixateur" or stabilizer being added.

Previous research at the Atlantic laboratories on stabilities of mixtures showed about 40% coal to be the optimum amount. The coals used were high volatile bituminous of about 37% volatile and 5 to 8% ash with ash softening temperatures ranging from about 2300 to 2700 deg. F. The oil had a viscosity of about 50 to 70 seconds Furol at 122 deg. F. The vis-

Fig. 1—Pulverized coal and oil mixing device, showing funnel for coal mounted on the suction line from tank to pump. Discharge line of pump runs to left over suction line

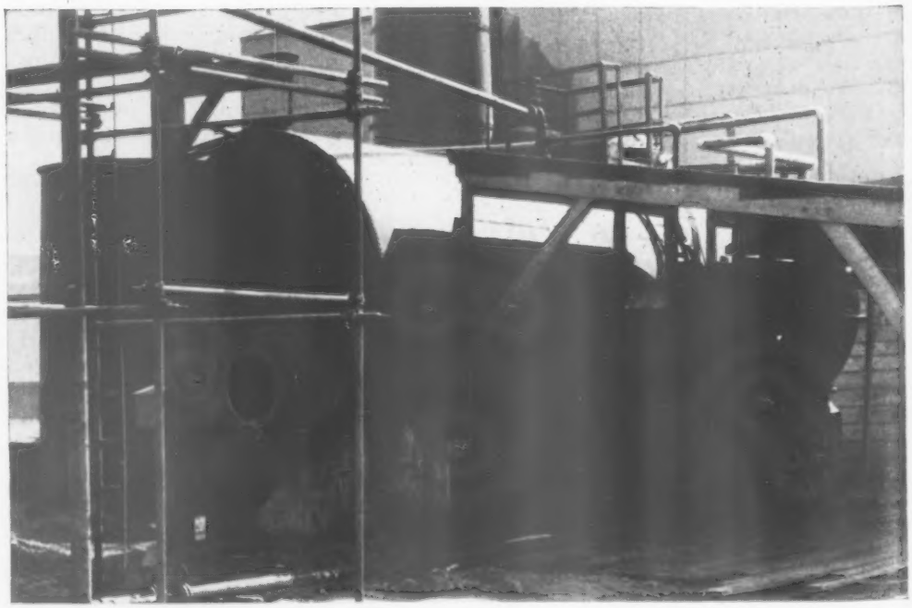

Fig. 2—Another view of coal-oil mixing device, showing the 2 horizontal pipes of the discharge line, the 2 orifices (lower left), the vertical pipe and horizontal pipe to top of tank

[1] Published by permission of the Director, Bureau of Mines, U. S. Department of Interior.
[2] Chief, Division of Solid Fuels Utilization for War, Bureau of Mines.
[3] Senior Fuel Engineer, Division of Solid Fuels Utilization for War, Bureau of Mines.
[4] Research and Development Department, Atlantic Refining Co., Philadelphia.

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cosity of the mixture was about 300 to 500 seconds Furol at this temperature.

Three different batches of fuel were burned, the main differences being in the fineness of the grinding of the coal. Batches of coal were ground to pass about 88%, 95%, and 99% through a U.S. Standard 230 mesh screen (62 microns), which is considerably finer than that ordinarily used at pulverized coal-burning plants. The Atlantic laboratory research indicated that the finer grinding would be necessary for a colloidal fuel that would be reasonably stable.

In general, it was found that the mixing of the coal and the oil required for the tests was less difficult than had been anticipated. A simple batch-mixing device shown in Fig. 1 and 2 was used. The fuel oil required for the batch, about 7000 gal., was put in the plant storage tank and then pumped from the tank suction line by an ordinary reciprocating pump. Its temperature was kept at about 85 deg. F. by steam coils in the tank. In the suction line, mounted on a tee and valve, was a funnel kept filled with pulverized coal. The coal under hand-valve control was allowed to flow slowly into the stream of oil on its way to the pump. The mixture was discharged by the pump through two horizontal pipes, each having an orifice near the end as shown in Fig. 2.

The two streams of fuel met at the base of the vertical pipe and passed on to the storage tank. The fuel was spilled into the tank at two outlets, one at each end of the tank. The coal was fed into the oil at the rate of about 1500 lbs. per hour, the fuel being continually circulated at the rate of about 9000 gal. per hour. After the required amount of coal was fed for the batch, the fuel was circulated for about 12 hours. Laboratory tests of samples of fuel taken at various places throughout the tank showed the mixture to be uniform. No further recirculating of the fuel was done during the burning tests at the boiler plant, the mixing device being valved off from the suction line.

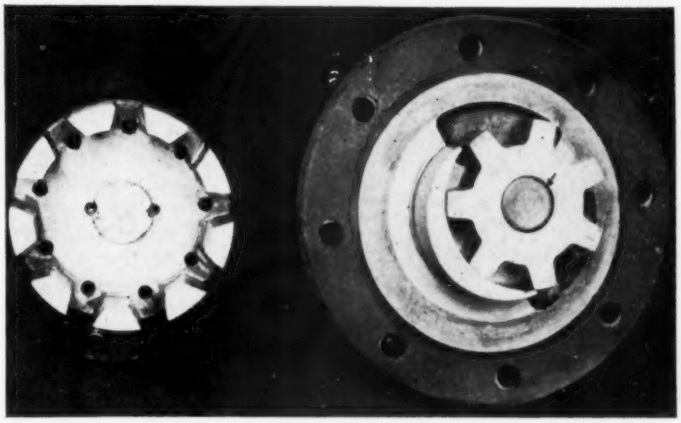


Fig. 4—Rotary type of oil pump used as part of the heater-pump set. Most of the erosion was at the spindle (arrow)

Tests Run on Typical Equipment

The boiler-plant equipment was typical of that of many oil-burning plants. The suction line from the outside oil storage tank ran underground about 100 ft. to the heater-pump set. A steam line, that helped maintain fuel temperatures to the pump, parallelled the oil suction line. Fig. 3 shows the heater-pump set. One pump was a reciprocating and the other was a rotary. Fig. 4 shows the rotary type. The fuel was heated to about 160 deg. to 180 deg. F. at the set and pumped about 110 ft. to the boiler. The burner used was a standard Best steam atomizing burner shown in Fig. 5 The fuel reaches a horizontal slot at the burner tip through the lower pipe; the steam reaches a vertical slot through the upper pipe and sweeps the fuel into the furnace. The fuel and steam were under hand control.

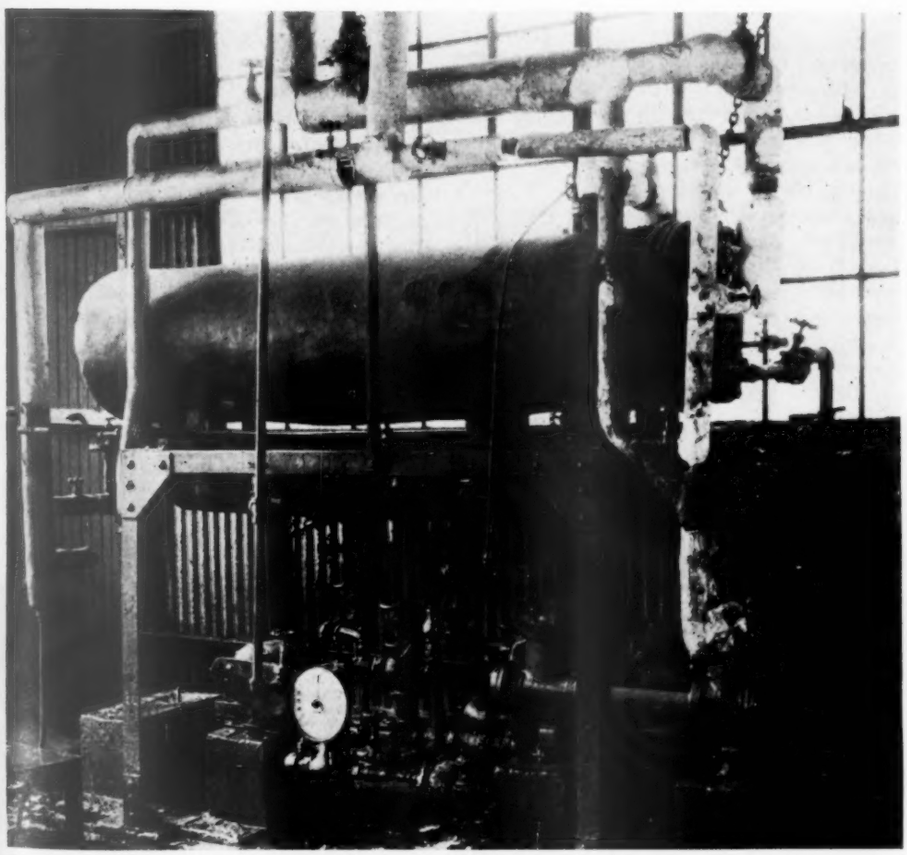


Fig. 3—Heater-pump set used on the tests

Typical Brick Set Furnace

The boiler was a 151-horsepower long-drum straight water-tube B & W, 8 tubes wide and 9 tubes high. Fig. 6 shows the boiler front. The furnace was a typical brick set furnace 10 ft. high at the front from the floor to the tubes and 6 ft. high at the rear. The furnace width was 5 ft. and its length 15 ft., giving about 600 cu. ft. furnace volume. The burner entered the furnace at the rear under a horizontal baffle extending about halfway the length of the tubes resting on the first row. The gases crossed through the tubes upward at the front of the boiler, then followed the usual vertical baffling, crossing the tubes twice more to reach the damper outlet at the top of the tubes at the rear.

The boiler was first operated on oil to establish normal operating characteristics. It was then operated continuously on colloidal fuel. Ratings from about 40% to over 200% were carried without difficulty, but for a considerable part of the test the boiler was operated at about 100% rating. At this rating, it was found that the suction at the oil pump dropped from about 1.5 lbs. per sq. in. pressure for oil to 4 in. vacuum for colloidal fuel. The pressure at the oil control valve was maintained for both fuels at about 30 lbs. per sq. in. At the burner the pressure for oil was practically zero, for colloidal fuel it was about 2 lbs. per sq. in. The steam consumption increased about 70%. The load on the pump increased. Under one set of operating conditions this load was about doubled. When colloidal fuel is being considered in present plant equipment, thorough attention should be given the problems of increased suctions, pressures and loadings on pumps. Pump capacities may be lowered.

Colloidal fuel has considerable abrasiveness. It acts something like a lapping powder. It is

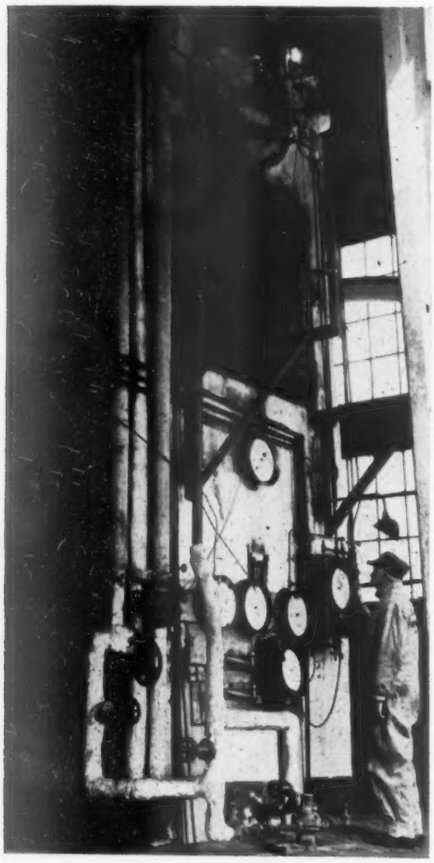


Fig. 6—Front view of the 151-Hp. long-drum straight water-tube B & W boiler used in the tests

doubtful, however, if this characteristic would necessarily be a serious handicap to successful operation. Equipment affected should be watched and repaired as found necessary. There was wear on the pump shown in Fig. 4, most of it at the spindle. No repairing, however, was found necessary during the run. There was also some cutting at the burner tip.

When colloidal fuel is being considered, the question always arises as to the possible settling out of coal from the mixture. This depends on many factors, such as fineness of grinding of the coal, type of oil, temperatures involved and agitation or movement given the fuel. Undoubtedly the finer the coal is ground the better it will remain in suspension. As a practical matter, however, it is desirable not to grind the coal any finer than necessary. Where most settling is apt to occur is in the heater. At this point, parts of the fuel are heated much higher than the average temperature of the fuel leaving the heater; the higher the temperature, the more the settling expected. In general, it is best not to have the fuel any hotter than necessary at any point in the system up to the furnace. Operating routine can be arranged to clean the heater as found necessary. If there are two heaters, they could be used alternately.

On the tests at the Atlantic Refining plant, it was found unnecessary to clean the heater on any of the runs that lasted about 7 days each. There was appreciable accumulation, however, in the heater when the 88% and the 95% coal through 230 mesh were used; there was practically none when the 99% coal was used. Some settling in the tank occurred with the 88% coal but none with the 95 and 99% as long as the storage tank was kept around 85 deg. F. No settling or clogging was experienced in the lines, although they were relatively long. There was some clogging in the meters and screens. Occasionally, throughout the day, the oil control valve tended to clog, but it could be readily cleared by opening it wide quickly. None of these difficulties were of moment. No boiler shut-downs occurred from operating troubles.

No difficulties arose in burning the fuel in the furnace with the steam atomizing type of burner. The flame responded smoothly to changes of boiler load and to variations of the quantity of air used for combustion. It could be controlled with equal ease to fuel oil. The CO_2 content of the products of combustion could be carried as chosen up to about 16% with no CO. Burning colloidal fuel after it is in the furnace does not present much of a problem. Experiments are now under way on the rotary cup-type of burner, which has shown good combustion.

Less Trouble Than Anticipated

Troubles from the ash of the coal in the furnace were less than had been anticipated. The use of pulverized coal has supplied a vast amount of information on the action of ash in boiler furnaces and passes. It is not desirable to re-explore this field to any great extent in connection with an emergency fuel. If a plant operator wishes to estimate about how much trouble he might have from ash, what those troubles are, and how they can be met, he might visit a few pulverized coal burning plants that are similar to his plant and operating with similar coal at about the same loads. In general he should expect much less ash troubles. Fig. 7 is a view of the furnace with the ash accumulation after about one week's operation. There was no dripping or slagging. The fly ash on the tubes was cleaned without difficulty every 8 hours during the test by the boiler soot blowers.

About the same boiler efficiencies were obtained with both oil and colloidal fuel.

At present there is no commercial source of colloidal fuel. Various concerns are considering its production. Larger users could consider settling up their own grinding and mixing plants. This is now being done by at least one oil user. Studies are now being undertaken by the Bureau of Mines and the Atlantic Refining Co. to arrive at a low cost mixing device. There is now on the market standard pulverizing equipment that will grind coal to the fineness of that used on the tests.

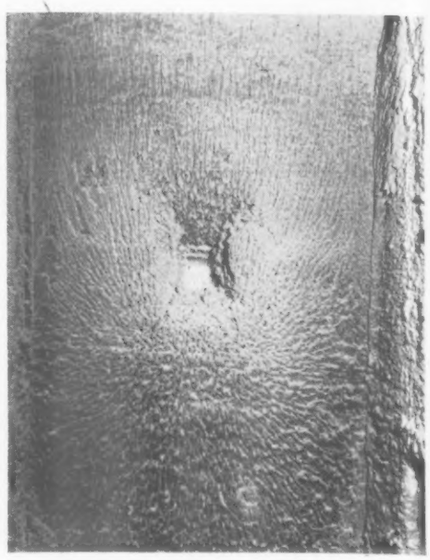


Fig. 7—Interior of boiler furnace, showing ash accumulation after about a week's operation

The question of costs is rather involved. How much can be afforded for the emergency fuel is an individual matter. The cost of equipment for complete conversion to coal may be very high. Under normal conditions in the past, the use of colloidal fuel has never proved itself to be an attractive proposition. Most oil-burning plants are in areas where under normal conditions it has been economical to burn oil. Colloidal fuel will cost more if the cost of handling, pulverizing, and mixing of the coal results in a coal B.t.u. cost higher than the oil B.t.u. cost. If needed equipment is obtainable, the Atlantic Refining Co. estimates that, on a production scale of 1,000,000 bbls. of colloidal fuel per year, this fuel could be sold in their area at about the same cost per million B.t.u.'s as that of the 16 gravity fuel oil now being delivered.

Inquiries regarding the tests should be addressed to the Bureau of Mines, Washington.

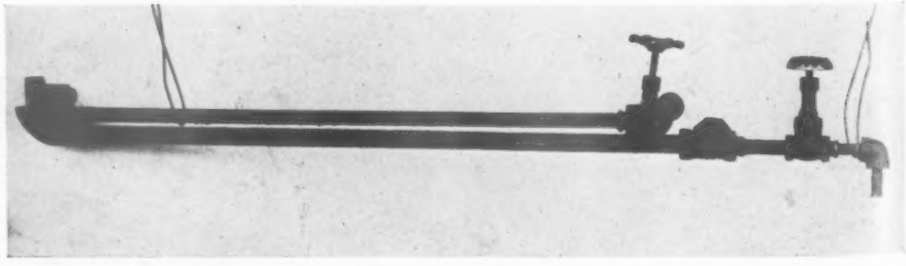


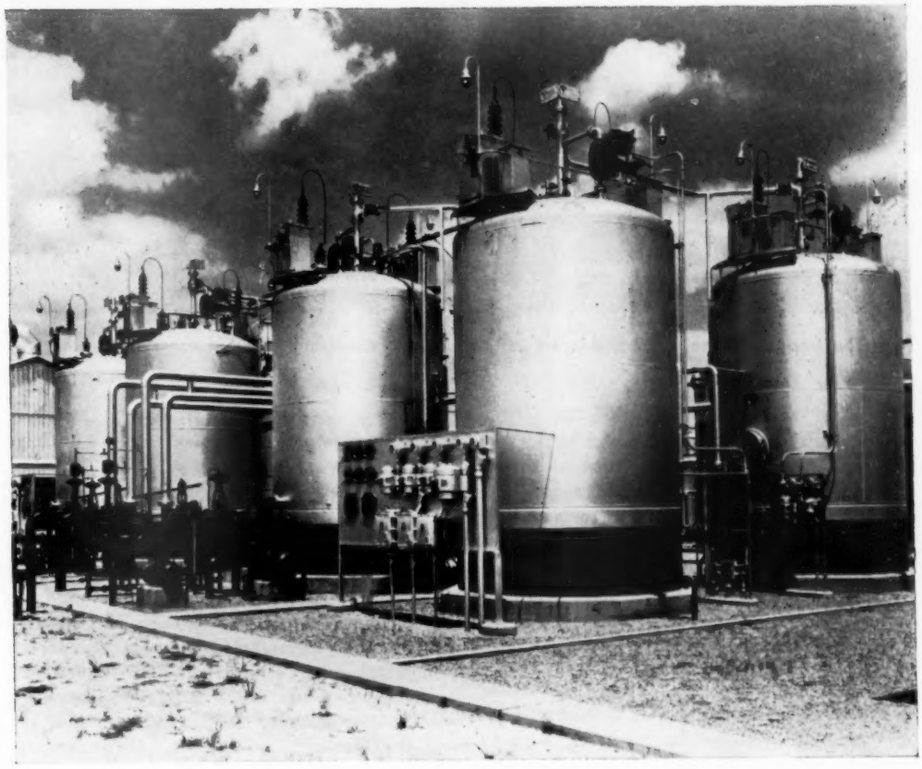
Fig. 5—Steam atomizing burner used. Fuel reaches a horizontal slot at burner tip through lower pipe; steam reaches a vertical slot through the upper pipe, sweeps fuel into the furnace

*Desalting** REFINERY CRUDE STOCKS

Even Small Amounts of Salts Damage Refinery Equipment and Detract from Quality of Products; Continuous Electric Process for Removing Chlorides is Described and Method for Salt Determination Presented

The increasing use in refineries of the sour crudes with their salts, sulphur compounds and other impurities, due to the urgency in the war program, has directed wider attention to the handling these types of crudes in a manner both to minimize the adverse effects on refinery equipment and to produce high quality products.

The accompanying discussion deals with salts of the chloride type and the advantages are given of desalting at the refinery where even small amounts are contained in the crude stocks. The deteriorating effect of the salts on refinery equipment is discussed and a standard method is presented for the analysis of charging crudes for salt determination. A continuous electric desalting process is described.



An 8-unit continuous electric crude desalting installation

IN THE majority of fields, the water produced with the oil contains large amounts of dissolved salts. The waters encountered in connection with refinery desalting operations are brines which range in concentration of salts from that of sea water to virtually saturated solutions.

The salts found in these brines will vary according to the field from which the oil was produced. The chlorides are most abundant, but sulphates are also present in appreciable proportions. The most prevalent of the chlorides is sodium, with calcium and magnesium next in order. These salts, together with sulphides in some sulphur bearing oils, can be found in practically all types of crude.

The accompanying tabulation (*Table* 1) shows the quantity of water extractible chlorides found in various types of oils. These oils were taken from refinery charging stock, and in some cases represent mixed crude being delivered by large pipeline systems:

These tests indicate that the oil from practically all the large producing fields in the Mid-Continent, Illinois and Michigan, as well as many others, contains large quantities of salt. It should be noted that the values in the table are for chlorides only, and do not include other salts such as sulfates, bicarbonates, etc.

All of the oils listed in the table should be desalted before charging to the refinery, if the adverse effects of salts are to be avoided. Determining the salt content of refinery crude stock is now routine in most refineries.

*From bulletin, "The Petreco Electric Desalting Process", of the Petroleum Rectifying Co. of California, Los Angeles.

Corrosion

Corrosion is one of the most serious of the adverse effects on refinery equipment caused by a salty crude charge.

The salts present in oils incompletely or non-desalted are a frequent source of corrosion in furnaces, towers, transfer lines, cooling and condensing units and other refinery equipment.

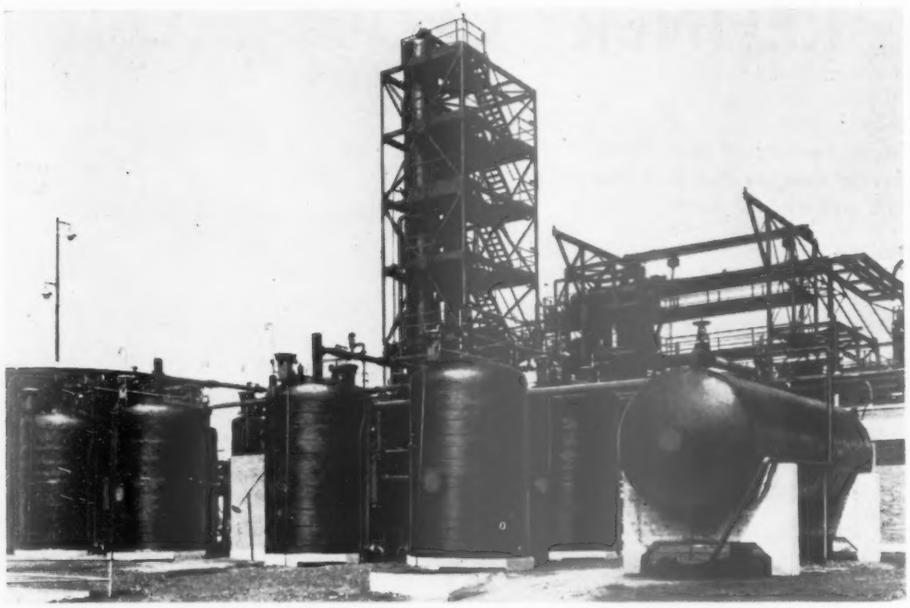
Magnesium chloride in charging stocks readily decomposes at high temperatures, liberating the very corrosive hydrochloric acid. Calcium chloride undergoes similar decomposition, especially in the presence of the organic acids always associated with crude oils. Furthermore, repeated quantitative experiments have demonstrated that even so stable a salt as sodium chloride also liberates hydrochloric acid in the presence of suitable organic acids under distillation conditions. The percentage decomposition of the several classes of chlorides in crude oils (to form hydrochloric acid), when subjected to distillation conditions, depends upon the total chloride content of the oil, the nature of the salts present, the strengths and concentrations of the mineral and organic acids in the oil, to a certain extent upon the water content of the oil, upon the maximum temperature attained, and on other refining conditions.

Heretofore it has been considered that refinery corrosion due to hydrochloric acid would not be appreciable when the oil contains a

TABLE 1—Quantity of Water Extractible Chlorides Found in Various Types of Crude

Producing State	Type of Crude	API Grav.	Cut BS&W	Salt ptb*
Arkansas	Schuler	33.7	0.3	77
California	Santa Maria	14.7	0.8	88
"	Ventura	28.9	0.6	64
"	Wilmington	18.0	0.7	102
Illinois	Illinois Basin	37.5	0.1	77
"	Illinois Basin	30.1	4.0	1200
"	Illinois Basin	30.2	1.0	318
Kansas	Mixture	34.1	0.2	47
"	Kans.-Okla. Mixt.	34.4	0.6	112
"	West Kansas	32.8	0.1	70
"	West Kansas	36.8	1.3	238
Louisiana	Lake Long	40.7	0.2	20
"	Rodessa	39.7	1.2	256
"	So. La.	36.9	0.3	51
Michigan	Mixture	35.0	0.2	142
Oklahoma	—	19.4	0.5	87
"	—	31.5	0.2	154
"	—	19.3	3.6	1750
"	Mixture	38.3	0.2	24
"	Okla. City-Burbank	37.6	0.5	35
Texas	Panhandle	38.4	0.4	279
"	Gray County	41.5	0.8	336
"	Ector County	34.1	0.5	156
"	East Texas	36.9	0.6	130

**Pounds of chlorides (as NaCl) per thousand barrels of oil.*



The treating vessels are insulated in this electric desalting plant at an Ohio refinery

total of calcium and magnesium chlorides less than some 10 to 15 lbs. per thousand barrels (p.t.b.). From the foregoing discussion, however, it is obvious that such amounts of calcium and magnesium salts can be highly corrosive. While it is difficult to assign any arbitrary limit to the total salt content of an oil below which corrosion due to hydrochloric acid will not occur, it is certain that maximum chloride removal will result in a minimum of corrosion. The chloride content of an oil, below which appreciable trouble due to hydrochloric acid corrosion will not be expected, depends upon the nature of the salts present, the properties of the oil, and the refining conditions imposed. In any event, the tolerable chloride content will be relatively low and all charging stocks should be carefully tested for potential corrosion.

Coking

Coking is another costly trouble caused by a salty crude charge. The deposition of coke in refining equipment, especially in furnace tubes and other cracking equipment, and also in shell stills and heat exchangers, is inescapable when processing crude oils at high temperatures. The coke from salty oils differs from that deposited from salt-free oils, and often the rates of deposition differ widely.

The coke deposited from salty oils contains a relatively high percentage of salts, sometimes amounting to 50% or more These salts fuse on the metal and act as nuclei for the deposition of additional carbon. Such deposition materially decreases on-stream time and is very harmful to refining equipment. It retards heat transfer and promotes over-heating, blistering and rupture of tubes. It is also harmful in accelerating hydrochloric acid corrosion, since the salts are retained in high concentration and in close proximity to the metal.

A further harmful effect of salts in the coke is that they serve to increase its hardness and density, thus increasing the difficulties in cleaning operations.

Plugging and Scaling

Plugging is one of the most severe process limitations imposed by salt. It is caused by the accumulation of crystalline salts in exchanger and condenser tubes. As these salts accumulate, the efficiency of the heat exchangers is impaired, and the retarded flow through the exchangers results in increased pressures on the refining equipment. Such plugging necessitates costly clean-outs and losses in on-stream time.

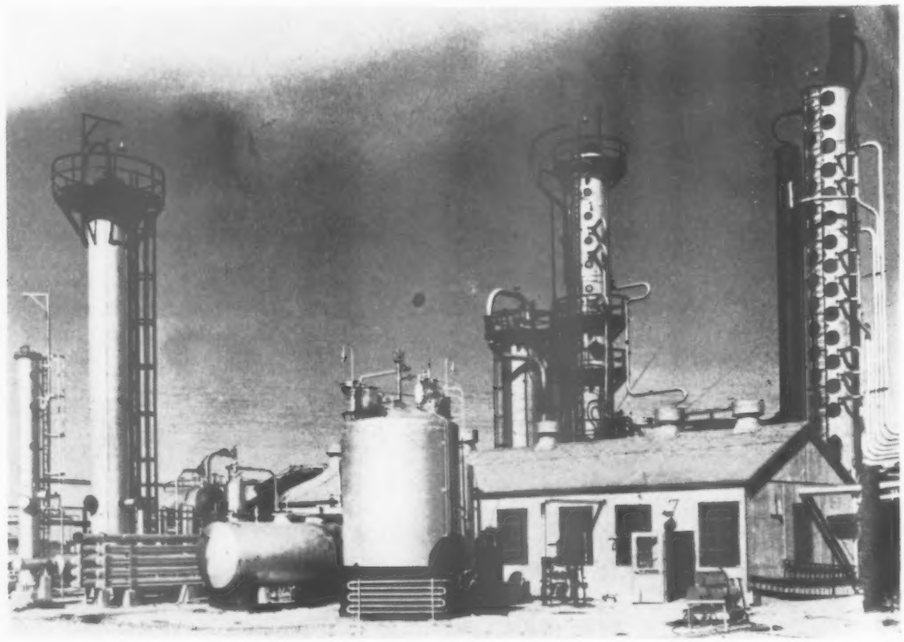
Scaling is another process limitation caused by a salty crude charge. It results from the deposition of scale-forming salts such as calcium carbonate and calcium sulphate. These scales are extremely hard and build up on the inside of lines, condenser and exchanger tubes, curtailing throughput, retarding flow and preventing efficient heat transfer, and are difficult to remove. Pieces of scale frequently become loosened and are carried along by the oil flow until they reach an exchanger where they lodge in the tubes and contribute to severe plugging.

Effect on Products

The effect of salts and other impurities on refined and residual products has been very definite in certain cases. This is particularly true in the case of asphalt. Since asphalt is a residual product, the adverse effects of the salts are multiplied. As refining operations progress, most of the salts not changed to HCl or deposited in the equipment become concentrated in the residuum. Thus, a crude charge bearing 100 p.t.b. of salt often will give 400 to 500 p.t.b. of salt in the residual asphalt.

Removal of salt from the crude oil reduces the insoluble matter, and enables the asphalt to meet stringent solubility requirements. It has been noted that in certain asphalts, manufactured for use as roofing materials, exposure to sunlight caused the asphalt to become brown when the crude charge was not desalted. One of the most important features of the removal of salts from the crude oil is that it imparts to the residual asphalt improved spot and ductility tests.

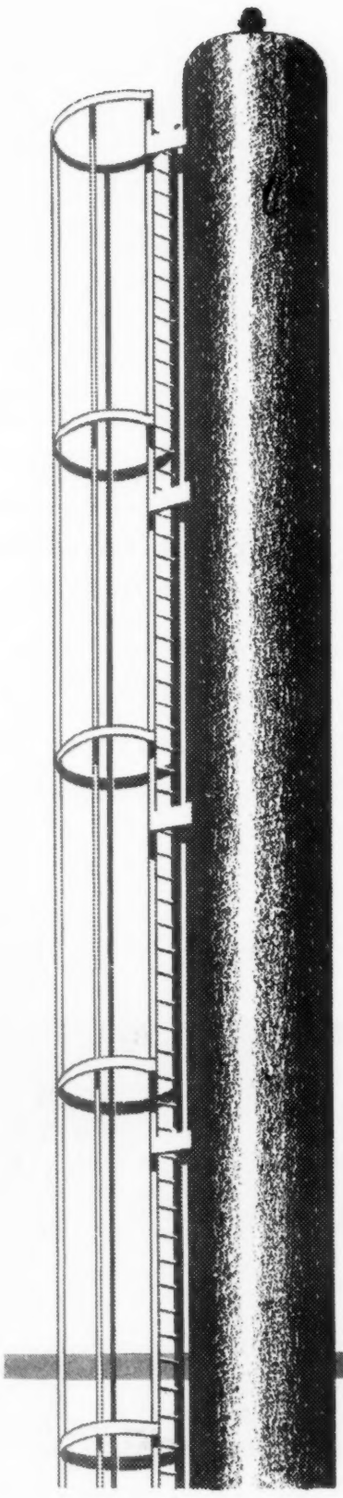
The lighter products also suffer from the effects of salt in the crude. Plugging and corrosion of vapor exchangers often causes leakage. When crude oil is one of the exchange media, leakage through the vapor side of the exchanger results in poor gasoline color. Beyond this, results obtained in certain refineries have indicated that gasolines from desalted



Single unit desalting plant, Kansas

Chemical Grade*

LIQUEFIED PETROLEUM GASES . . . For the PETRO-CHEMICAL INDUSTRY



Just "so much"—no more, no less. Generally speaking, this statement best describes the exacting requirements of the Petro-chemical Industry, as applied to the properties of liquefied petroleum gases. Warren's Chemical Grade Liquefied Petroleum Gases are "built" to fit these requirements, not once or twice, but always.

Chemical Grade Liquefied Petroleum Gases are made by processes which both control and specifically establish their properties. Thus, their dependability is worthy of your trust, without reservation.

Normal Butane, Iso-Butane, and Propane (Warren's Chemical Grade "family") must not be confused with ordinary liquefied petroleum gases which are used for fuel. The fact is, their rigid uniformity directly contrasts with the variable properties of the "fuel type" gases. Chemical Grade Liquefied Petroleum Gases are for use in the production of fighting motor fuels, high-quality lube oils, synthetic rubber and many chemicals and plastics.

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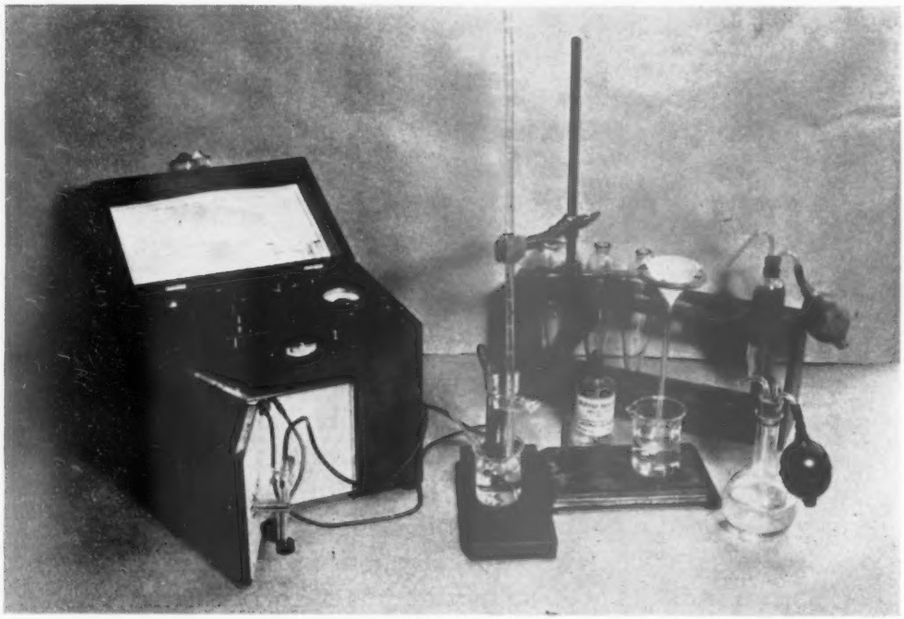
Tulsa, Oklahoma
Manufacturers, Exporters and Marketers of
Natural Gasoline and Liquefied Petroleum Gas

Export Terminals: Corpus Christi, Port Arthur and Norsworthy, Houston, Texas, Lake Charles, La., and Marcus Hook, Pa.



Laboratory equipment for electrometric titration in acid solution

crude showed improved lead susceptibilities. This was clearly demonstrated in one refinery where a considerable saving in tetra-ethyl lead was effected. Salty crudes have been found harmful to the quality of the resulting naphtha, kerosene and other light products. In some instances desalting has greatly stabilized the kerosene color and improved the quality as indicated by the burn tests. Improvement in naphtha odor also has been cited as a result of desalting. In the refining of many light products, the amount of treatment required after distillation has been reduced materially by desalting the crude charge.

In the manufacture of lubricating oil, some salts may be carried over in the residual lube stocks. In some cases, salts have even been present in the finished products. Such pollution, of course, is highly undesirable and cannot be tolerated in high quality lubricants.

Fuel oil, when manufactured from salty crudes, will often carry a dangerously high percentage of salt. Since it is a residual product, the bulk of the original salt content will be concentrated in the fuel oil. The desalting of crude oil has, in some instances, resulted in the production of fuels that have commanded premium prices over and above that previously obtained.

Necessity for Salt Analysis

Frequent salt determination analysis of charging stocks should be made by the refiner to guard against the presence of salt in the crude oil. A standard method which has been found suitable for many different types of crudes is described below[1]:

1.—Measure 50 ml. of the oil sample, 50 ml. benzol, 25 ml. acetone and 75 ml. distilled water into a 250 ml. cylinder. The oil volume should be accurately measured, preferably with a pipette which is rinsed with the subsequently added solvents.

2.—Heat to 120 deg. F. and emulsify thoroughly by agitating with a piston made of a brass rod to which has been affixed transversely a brass disc whose diameter is slightly less than that of the cylinder. A metal cylinder is advantageous for more expeditious heating. When the time is available, a short soaking period improves the initial extraction.

3.—Transfer the contents of the cylinder to two centrifuge tubes, warm to 120 deg. F., and note whether a fairly clear water separation has occurred. If not, add 1 drop of demulsifying chemical, Tretolite compound L 10,396 to each tube, and mix by shaking.

4—Centrifuge for 10 minutes at 1500-1800 r.p.m., and then siphon or pipette off all of the free water in the tubes through a filter paper into the titrating vessel. Take care that no sludge material is removed from the tube.

5—Add an additional 10 ml. water to each tube, heat to 120 deg. F., shake thoroughly, and again centrifuge.

6—Remove the water completely to the filter previously used, and wash and filter with a little distilled water.

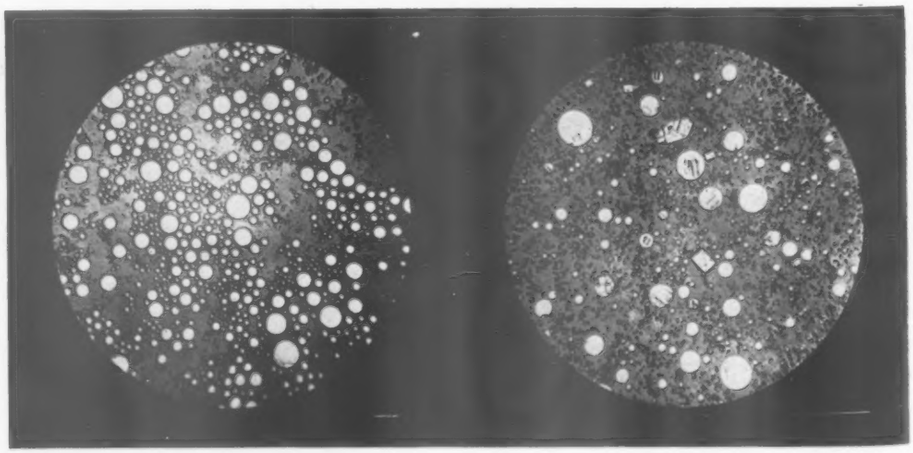
7—The extract obtained may then be analyzed for chlorides or other constituents by standard methods. For the determination of chlorides, the Mohr method may be used, but electrometric titration in acid solution is preferable because the nature of the extracts often causes color and other interferences in the former method.

The analytical results obtained in testing for salt content are variously expressed in terms of grams per barrel, pounds per thousand barrels, or other units, depending on the basis upon which operations usually are conducted. In the U. S. the preferred units are pounds per thousand barrels of oil of 42 gallons each. In order to facilitate conversion into any desired units, the accompanying table of conversion factors is included (*See Table* 2).

Continuous Electric Process Described

The Petreco electric desalting process usually is employed at the beginning of the refining operation and utilizes relatively low temperatures and pressures. The process ordinarily is carried on at from 140 deg. F. to 220 deg. F., a range usually available after the charging stock has passed through the first heat exchanger.

Fresh water of approximately the same temperature is dispersed in the oil under controlled conditions, and the resulting mixture is immediately introduced into an electric field where the action of the electric current coalesces the original brine particles with the dispersed fresh water particles. The combined



The photomicrograph at the left is of a crude oil emulsion containing approximately 25% water. At the right is a similar emulsion which has been exposed to the air, thereby allowing some evaporation of the water to occur. Much salt has crystallized out, indicating the high salinity of the brine associated with the oil

[1]Standard test method of Petroleum Rectifying Co. This and other test procedures are described in the Petreco Bulletin, "The Determination of Salts in Crude Oil."

water quickly separates from the oil and is continuously withdrawn from the desalter.

Exhaust steam is often used to bring the water up to the required temperature. The proportion of water used varies considerably with different charging stocks and the degree of salt removal required, satisfactory operation having been obtained with some oils with as little as 5% by volume of water, while with others as high as 20% is used.

One essential characteristic of a satisfactory desalting process is that it be incorporated into the refinery system in such a manner that the charging stock may be treated "on-stream" without an intermediate prolonged settling period. The Petreco process requires no separate settling step, the water separation taking place within the electrical unit. Desalted oil leaves the top of the electric unit and is charged directly to the refinery, while the water containing the extracted salts is continuously withdrawn from the lower portion.

Gravities of the oils effectively treated by this process have ranged from 17.8 deg. A.P.I. to as high as 44.0 deg. A.P.I., and the salt contents from less than 10 p.t.b. to over 1700 p.t.b.

The electric treater proper consists of a pressure vessel 10 ft. in diameter by 12 ft. in height, having a volumetric capacity of about 185 bbls. The tank (A) is built according to A.P.I.-A.S.M.E. specifications. In the vessel are suspended two or more electrodes (B) which form the treating field. These electrodes are held in position by suitable insulators (C). The requisite high potential is conducted through the treater tank by means of insulator entrance bushings (D). Special step-up transformers (E) are mounted on top of the treater tank, and are supplied with alternating current at 230 or 440 volts through a suitable control panel (F). Reactance coils (G) and automatic switches regulate the power going to the transformer, preventing overloads of the line and equipment. The transformers are rated at 5 k.v.a. and commonly operate at potentials of from 16,500 to 33,000 volts.

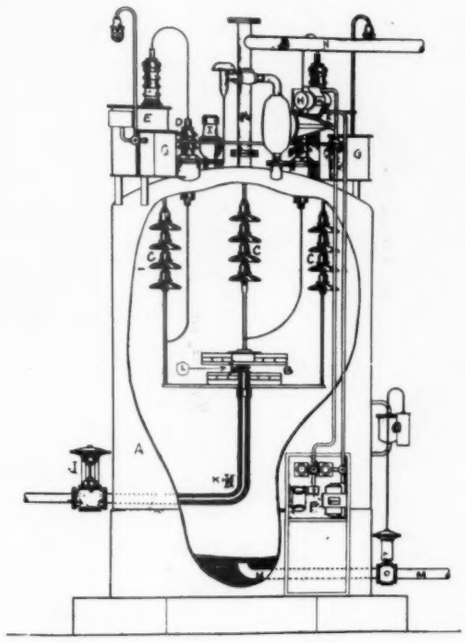


Diagram of interior of treating vessel

An automatic switch (H) at the top of the treater serves to control the power to the unit so that when the liquid level is lowered for any reason, the power is cut off. Electricity thus can be delivered to the electrode system only when the treater is full of liquid. A pressure relief valve (I) contributes further to the safety of operation.

The crude oil and fresh water are emulsified by an automatically controlled and operated emulsifier (J), the resulting mixture entering the desalter via the inlet (K). The inlet piping conducts the mixture to the distributor (L) which releases the mixture so that it is immediately subjected to the electric field between the electrodes (B).

The action of the high potential electric field is to coalesce the added fresh water particles with the original brine particles in the oil. As this coalescence progresses, the combined fresh and salt bearing water settle rapidly from the oil and are discharged through the water draw-off (M). The desalted oil discharges at oil outlet (N), flowing on through the refinery system.

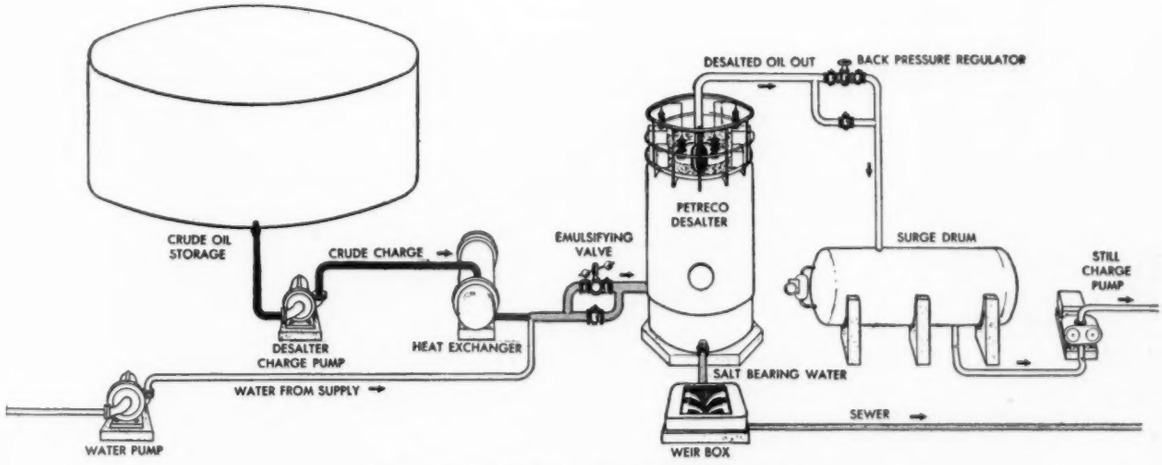
A predetermined water level is maintained by an automatic gravity differential water level controller (O).

TABLE 2—Conversion for Salts in Crude Oils

mg. per liter (1)	grams per bbl. (2)	pounds per 1000 bbls. (2)	grains per U.S. Gal.	grains per B.I. gal.	grams per metric ton (3)
1.	.159	.350	.0584	.0701	1.176
6.29	1.	2.20	.367	.441	7.40
2.85	.453	1.	.167	.200	3.36
17.1	2.72	6.00	1.	1.20	20.1
14.3	2.27	5.00	.833	1.	16.8
.85	.135	.298	.0497	.0596	1.

(1) Approximately the same as "Parts per million" (P.P.M.)
(2) 1 barrel = 42 U. S. Gallons.
(3) For oils of specific gravity 0.85 (35° A.P.I., 34.7° Be') at 60° F.

NOTE: *When it is desired to compute approximate salt content of oils from analyses of the brine, it is necessary to multiply those results by 1/100 of the total water content (expressed in per cent) of the oil.*



Layout of complete electric desalting unit

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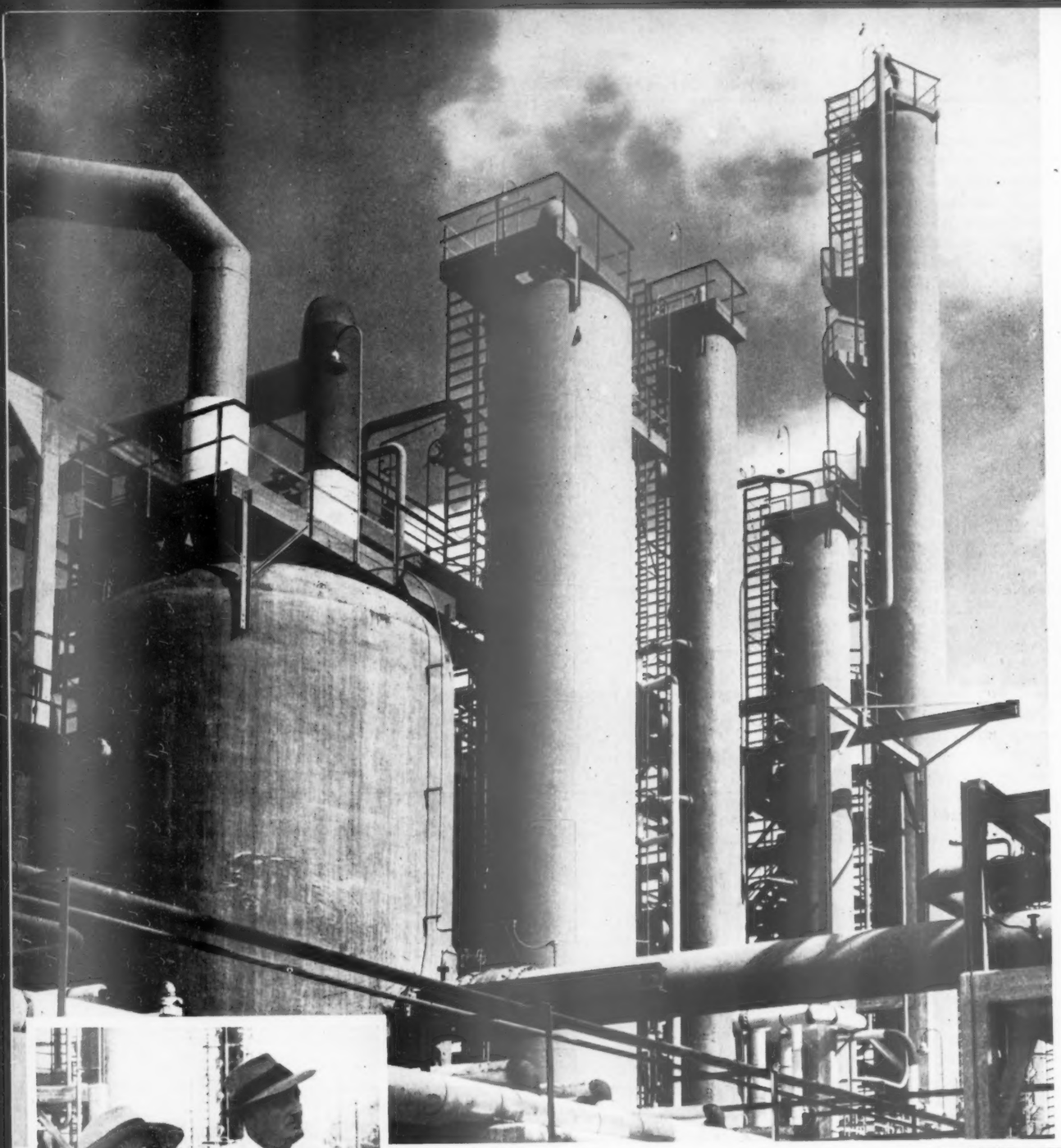
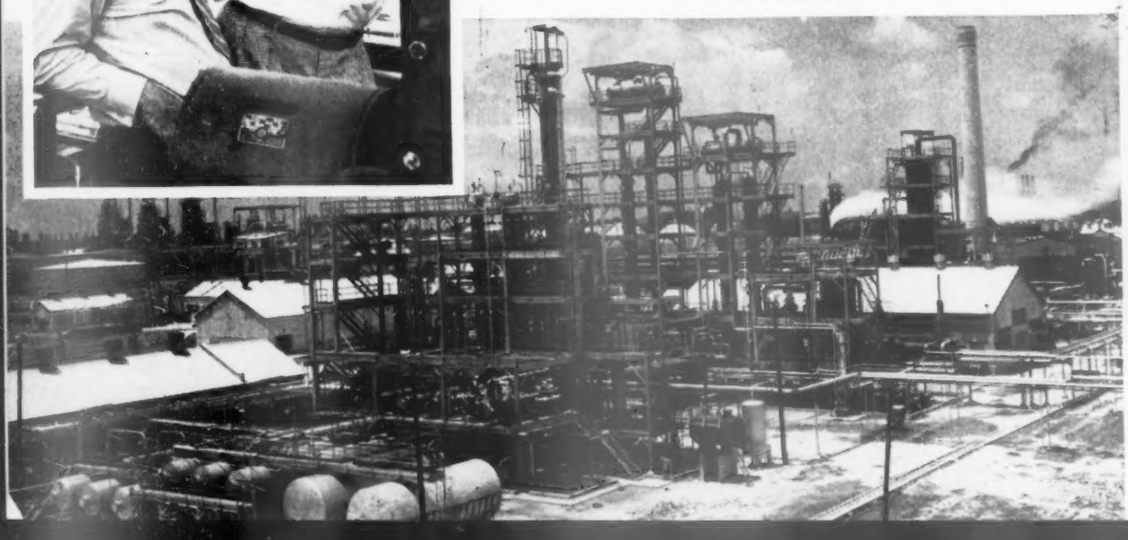


Left: Fig. 1—Towers and reactors of the fifth butadiene plant at the Baton Rouge refinery of Standard year. It is the first of the so-called "standardized" butene dehydrogenation units under the government's rubber program

Right: Fig. 4—Alkylation section of the Baton Rouge refinery where iso-butane is combined with butenes or other olefins from the fluid catalytic cracking units to produce a blending agent for 100-octane gasoline

M. W. Boyer and M. J. Rathbone, vice-president and president, respectively, of Standard Oil Co. of Louisiana

Below: Fig. 2—First butadiene plant at the Baton Rouge refinery. It was planned before Pearl Harbor and has been in operation since January, 1942. By thermal cracking of oil the plant produces a number of gases, including butadiene which is extracted from the gas stream



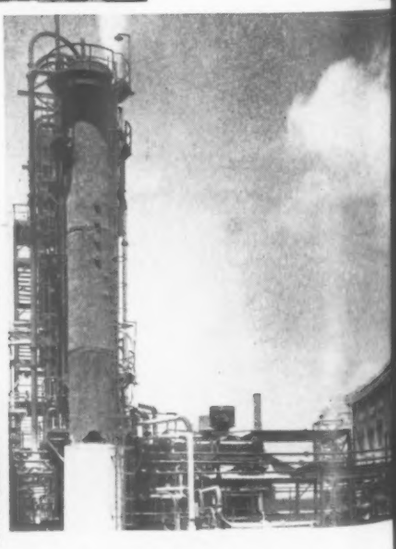


Fig. 3—This hydrogenation plant at B Harbor was the largest in the world m was built in 1931 to make lubricating process. Later it became the first plan line on a large scale. At the left are the right the concrete stalls in which t the hydrogenation unit

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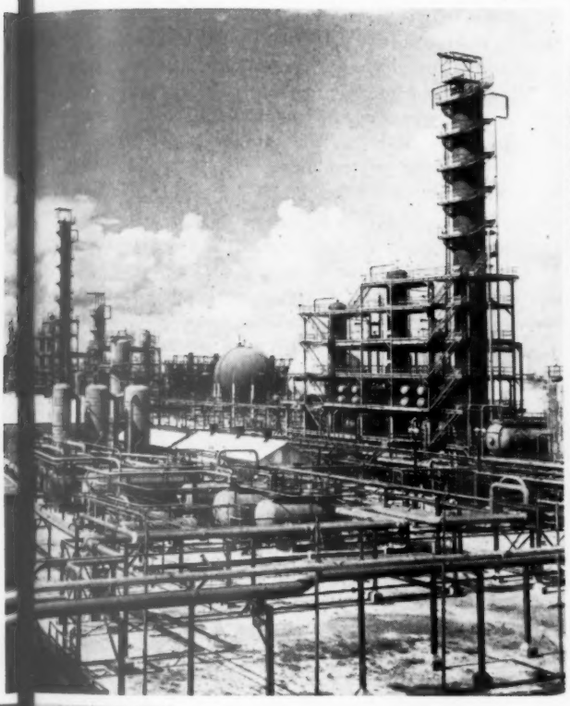
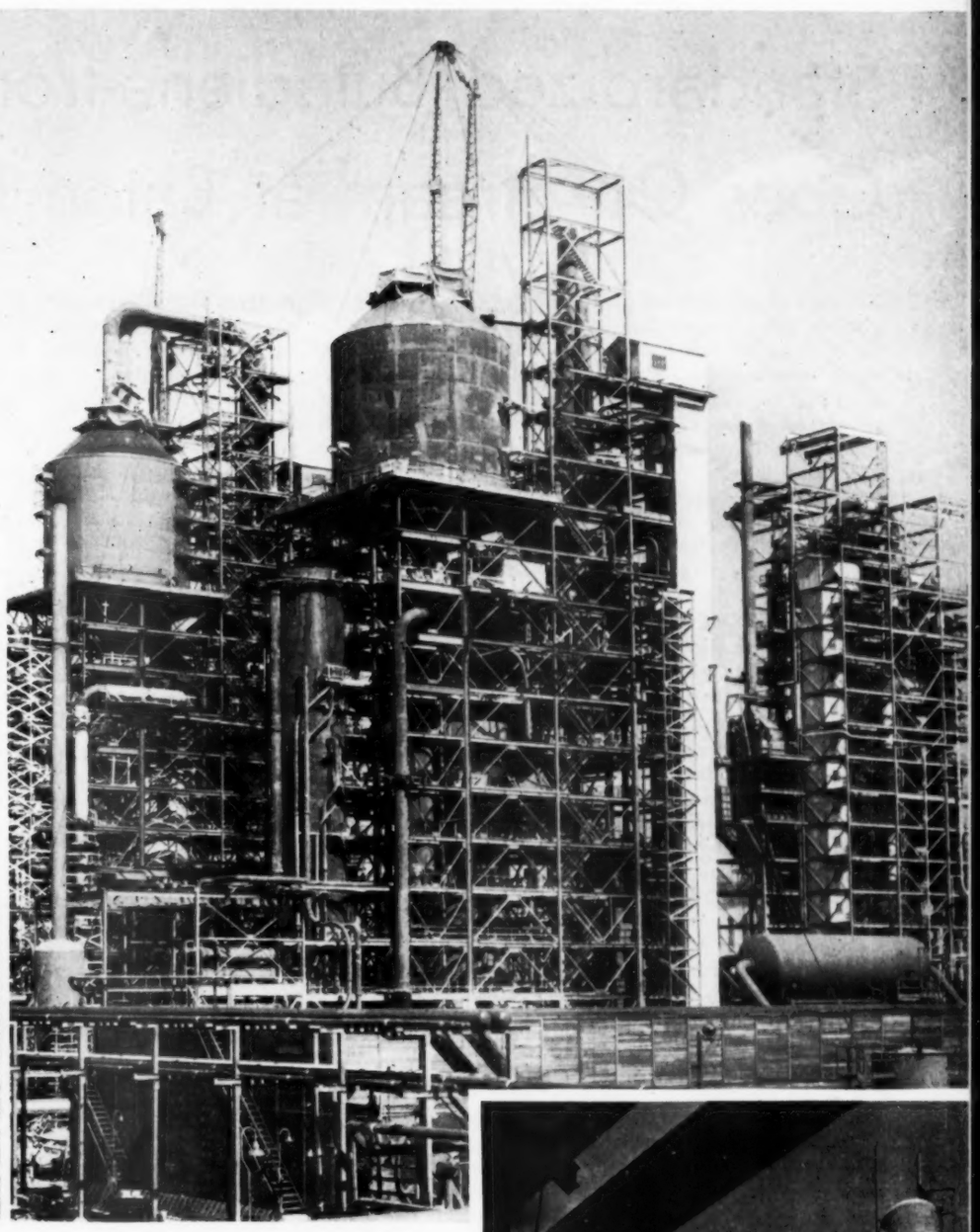
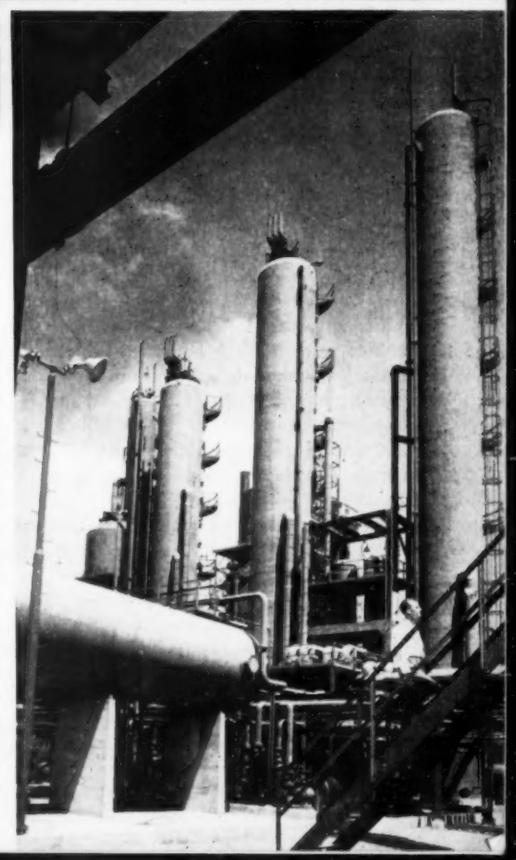
d equipment at the Baton Rouge
Co. of Louisiana is also supplying
petroleum products.

Article pg. R-314)







Upper right: Fig. 5—At the left are the two new fluid catalytic cracking units at Baton Rouge. They will produce primarily base stocks for 100-octane aviation gasoline; also butene which may be alkylated to make a blending agent for high octane fuel or dehydrogenated to make butadiene. These crackers also yield toluene for explosives. At the right is the first fluid catalytic cracking unit put in operation early in 1942

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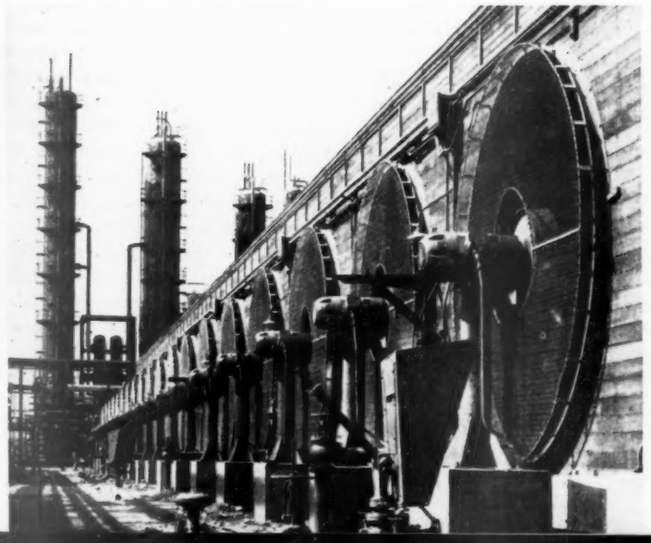

Right: Fig. 6—Gases produced in the fluid catalytic cracking plant at Baton Rouge are separated in this debutanizer and splitter unit into the raw materials for synthetic rubber, 100-octane gasoline and toluene

Left: Fig. 7—These giant fans at the Baton Rouge refinery cool water for the various processes

Standardized Butadiene-from-Oil Plant Goes On Stream at Baton Rouge

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"Cradle of the synthetic rubber industry".

So the Baton Rouge refinery of Standard Oil Co. of Louisiana was termed by visiting dignitaries attending the formal opening May 30 of its fifth butadiene plant, to emphasize the importance of the development work in the manufacture of synthetic rubber which has taken place there.

This new butadiene plant now in full operation marks the completion of this company's contracts with the government for construction of butadiene manufacturing facilities at this point. It is also the first large size government financed plant to operate under the butene dehydrogenation process which has been selected as the principal butadiene-from-oil process in the government's rubber program. (See Fig. 1 on preceding page.)

The Baton Rouge refinery, selected several years ago by Standard Oil Co. (N.J.), parent of the Louisiana company, as the location for research and semi-commercial work on new processes, also is the actual birthplace of many important technical developments in petroleum refining and in the new chemicals-from-oil field.

Commercial operations at this refinery, which in 1942 processed approximately 41,000,000 bbls. of crude, include the production of high octane gasoline, toluene for explosives and other chemicals derived from petroleum, in addition to synthetic rubber. On its 1000-acre site is said to be concentrated a greater variety of equipment and processes for making petroleum products on a commercial scale than can be found elsewhere in the country. A nearby tank farm on another 1000 acres provides storage for millions of barrels of crude and products.

The five butadiene plants at Baton Rouge have an annual capacity for making one of the principal ingredients of synthetic rubber sufficient to supply several million automobile tires. Two of the plants were financed entirely by Standard Oil Co. of New Jersey, another is owned by the Defense Plant Corp. and two were built or equipped cooperatively by the company and the government. The company has invested $12,050,000 in these plants, the government $11,507,000. The plants employ two types of processes for manufacturing butadiene—thermal cracking and butene dehydrogenation.

"This is a milestone in the synthetic rubber program", said an official of the Standard of Louisiana on the occasion of the opening of the latest plant. "It means not only that we have fulfilled our commitments to the government for the construction of butadiene plants at this point but that we have also proved the practicability of large-scale commercial production of this vital synthetic rubber raw material from oil by two of the principal processes to be employed in the government program. This was made possible by intensive research and the commercial application of a tremendous store of chemical engineering knowledge accumulated during the two years before the war."

The first butadiene plant at Baton Rouge was started many months before Pearl Harbor. It is said to be the first plant in the world specifically designed to make butadiene from petroleum on a commercial scale. By thermal cracking of oil it produces a number of gases, including butadiene which is extracted from the gas stream. It was built to augment the supply of butadiene for the Perbunan rubber plant at the same refinery and was completed in January, 1942, being entirely financed by the company. See Fig. 2.

The second butadiene plant is of the same type as the first but of larger capacity. It was completed in January, 1943, being financed by the oil company. The butadiene it produces is bought by the government and allotted to synthetic rubber plants.

The third plant was the first of the so-called "quickie" units in the oil industry's program to supply butadiene from existing refinery facilities during the period the permanent plants were under construction. It consisted of oil refinery equipment converted to this purpose. It started operations in March, 1943.

The refinery conversion units in general involve remodeling existing equipment to permit cracking light petroleum fractions such as heavy naphthas or light gas oils at relatively high temperatures in the presence of steam. The butadiene is absorbed from the gas stream by a special solution, the extraction being both in the liquid and vapor phase. The absorbing solution is then regenerated and the butadiene from the gas purified by fractional distillation.

The great quantities of butadiene required by the government's synthetic rubber program could not be produced practically by thermal cracking operations as carried on in these early plants. The Standard's process for dehydrogenating butene gives a relatively much larger yield of butadiene and uses as raw material refinery gases made as an incident to the manufacture of 100-octane aviation gasoline. The fourth butadiene unit at the Baton Rouge refinery was a small scale plant (approximately 3300 tons a year) which served as a pilot plant for the main government program for producing butadiene from the gases from aviation gasoline plants. This plant was completed this spring. The fifth plant, a large scale unit with capacity of 15,000 tons per year, opened to full operations May 30 is the first of the so-called standardized butene dehydrogenation units under the government program.

The process involves passing butene over a catalyst at high temperatures and low pressures. The reduced pressures are secured by the use of steam. The early catalysts used in butene dehydrogenation were poisoned by steam but catalysts were later developed which overcame this difficulty. In the operation of the new butadiene unit at Baton Rouge the refinery gas stream, rich in normal butylenes, is first purified to increase the concentration of normal butylenes in the feed stock. The gases are then diluted with steam and subjected to high temperatures in contact with the dehydrogenation catalyst. The catalyst is regenerated periodically by treatment with steam at high temperatures.

After conversion of butene to butadiene, the reacted gases are fractionated to separate normal butylenes for recycling. The butadiene stream is purified in equipment similar to that used in purifying butadiene from the direct cracking or refinery conversion plants.

The 5 butadiene plants supply all the butadiene needed by the Co-Polymer Corp.'s new 30,000-ton per year plant adjoining the Baton Rouge refinery, where it is copolymerized with styrene to produce Buna S rubber. This is one of the new standardized government copolymer plants. In addition the butadiene units supply the Standard Oil Co. of Louisiana's own Perbunan rubber plant and additional butadiene is shipped in tank cars to other copolymer plants.

Other rubber manufacturing facilities at the Baton Rouge refinery include a plant for making Perbunan (Buna N) and a butyl rubber plant. The former, placed in operation in April, 1941, was one of the first plants in the U. S. for making Buna rubber on a commercial scale. Its present capacity is 3650 tons annually. In this process butadiene is combined with acrylonitrile to make a rubber for many specialty uses.

In the butyl rubber plant, isobutylene produced at the refinery is combined with small amounts of isoprene, obtained from turpentine or from oil. This type of synthetic rubber was developed as a laboratory product by Standard Oil Co. (N.J.) scientists in 1937 and improved by continuous research so that it now plays a small but important part in the government rubber program. Butyl has not yet matched the tire-making characteristics of Buna S. It can, however, be used to make inner tubes superior to those made from Buna S or natural rubber. Some of its important properties are resistance to oxidation and action of acids and high impermeability to gases and it is used in making a diversified list of products where these properties are an advantage. The

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Butyl Rubber Output at Baton Rouge Soon to Reach 38,000 Tons a Year

Left—Butyl rubber, first production plant of which is now in operation at the Baton Rouge refinery of Standard Oil Co. of Louisiana, is shown coming out of the polymerization plant as small curds floating in a water stream. Isobutylene, produced at the refinery, is combined with small amounts of isoprene, obtained from turpentine or from oil, to make the butyl rubber.

Above—The butyl rubber rolling out of an extruding machine a few hours before was in the form of two refinery gases. Production of this type of synthetic rubber at Baton Rouge is expected to reach 38,000 tons by the end of this year

butyl rubber plant at Baton Rouge will be operating at an output rate of 38,000 tons a year by the end of 1943.

At the Baton Rouge refinery also is the largest high pressure hydrogenation plant in operation in this country and the only one used for processing an entire range of petroleum products. The hydrogenation process, which involves exposing light distillate to hydrogen gas in the presence of a catalyst and under high pressure and temperature, is an outgrowth of technique obtained from German scientists. The plant was completed in 1931 and first put into operation making lubricating oils. It later served to pioneer many of the possibilities of the hydrogenation process as applied to petroleum refining, including high octane aviation gasoline. Until the entrance of the U. S. into the war it is believed this plant was the largest in the world for the manufacture of 100-octane gasoline.

This plant is still in operation but its processes have been altered in line with war needs and its utility greatly increased. Through arrangements worked out by the office of Petroleum Administrator for War, the main portion of the plant, which was formerly used to make base stock for 100-octane gasoline, is now used to complete the processing of partly finished blending stock supplied by a number of other refiners. The effect of this arrangement is to increase greatly the total amount of aviation fuel available. See Fig. 3.

There are several alkylation units at the Baton Rouge refinery which have been in operation for a number of years to supply a blending agent for aviation gasoline through the alkylation of iso-butane with butylene or other olefins supplied by the fluid catalyst cracking units. See Fig. 4.

The first fluid catalytic cracking unit in the world was put into operation at the Baton Rouge plant, early in 1942. Two other units now being built there are expected to be in operation in a few weeks, primarily producing base stock for 100-octane aviation gasoline. See Fig. 5. In addition these cracking units produce a great deal more butene than is obtained from ordinary thermal cracking. This butene can be alkylated to make blending agents for high octane fuel or can be dehydrogenated to make butadiene for Buna rubber. They also yield toluene for explosives.

The fluid catalytic "crackers" therefore are in the position of "mother plants" to the production of war materials. The gases they produce are processed in the debutanizer and splitter plant (See Fig. 6) and separated into the raw materials for synthetic rubber, 100-octane gasoline and toluene which goes into the manufacture of TNT.

Some idea of the magnitude of refining operations at the Baton Rouge plant is given in Fig. 7, which shows a row of giant fans used for cooling water for refinery processing.

At the Baton Rouge refinery also is the first plant constructed in this country for the manufacture of catalysts necessary for catalytic refining of various petroleum products. Practically all known types of catalysts used in petroleum processing have been manufactured at this plant, as well as catalysts for the manufacture of hydrogen from refinery or natural gas and for the production of hydrogen by the conversion of carbon monoxide to carbon dioxide with steam. Much of the pioneering work in commercial scale manufacture of catalysts is said to have been carried out at this plant and in many respects it is responsible for the basic development of catalyst producing techniques in this country.

At this refinery also ethyl and isopropyl alcohol are produced by the synthesis of petroleum hydrocarbons.

The Standard Oil Co. of Louisiana marked its 34th anniversary April 13, 1943. In the year of its founding, 1909, a 213-acre cotton plantation was purchased for the Baton Rouge refinery site. Today the refinery alone covers 1000 acres and another 1000 acres is occupied by the tank farm. In the 1920's the Baton Rouge refinery was selected by Standard Oil Co. (N.J.) as the principal location for development work on new processes and new commercial-scale equipment. As a result, it has been the birthplace of many important technical developments in the petroleum field. In its commercial operations the plant is the nucleus of multiple industries in Louisiana. It has grown to include extended chemical processes, drawing from petroleum numerous new products and attracting around it varied plants. Daily some 110,000 bbls. of crude oil flow into the refinery. In 1942 the refinery processed in its stills approximately 41,000,000 bbls. of crude oil. Operations are carried on by almost 8000 regular employes.

The opening of the new butene dehydrogenation butadiene unit at the Baton Rouge plant was made the occasion of a visit May 30 and 31 by U. S. Rubber Director William M. Jeffers and members of the War Agencies Joint Inspection group. Other key men in the party from Washington included Undersecretary of War Robert Patterson, Undersecretary of the Navy James V. Forrestal, Ralph K. Davies, Deputy Petroleum Administrator for War and Bruce K. Brown, Assistant Deputy Petroleum Administrator.

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CATALYSTS of the Activated Montmorillonite Type*

Fig. 1. Raw clay mine showing benching, stripping, cleaning, digging and loading operations. The drainage ditch and overburden disposal are on the right

The increased demand for high octane gasolines has led to the widespread commercial employment of catalysts in petroleum processing. Although both natural and synthetic catalysts are used, the discussion here is limited to those falling in the natural category.

The early application of the activated montmorillonitic type clay for petroleum cracking and the factors affecting the catalytic activity of the clay—both as to original raw material and its subsequent treatment—are reviewed. There is also a resume of the theories of catalytic mechanisms as applied to activity and an outline of how these various conditions have led to the development of controlled natural catalysts for meeting wartime petroleum requirements. The main uses in catalytic cracking and other possible applications in heterogeneous catalysis are briefly outlined.

By R. C. Davidson,**
F. J. Ewing**
and R. S. Shute**

1. Introduction

THE purpose of this paper is to present a discussion of natural catalysts, that is, catalysts made from naturally occurring clay substances, with emphasis on their application to petroleum oils. Although a great deal has been written on the catalysis of petroleum oil, the main consideration here is an approach to the subject from the standpoint of clays in their physical and chemical characteristics as a catalyst. Many important research and production details have been omitted as it is not advisable to permit their release at this time.

2. Montmorillonite Clay

Clay is the name of a material which is widely found throughout the crust of the earth and whose main constituent is hydrous aluminum silicate. There are many types of clay, the bentonites forming one of the significant classifications, and within the bentonitic group are found the non-swelling or, as they are sometimes referred to, the subbentonites. These non-swelling bentonites furnish the commercial source of one of the most important clay minerals — montmorillonite — which has the ideal formula of $Al_2Si_4O_{10}(OH)_2nH_2O$.

Non-swelling bentonites are formed from the geologic alteration of volcanic ash and as far as can be ascertained, the environment and conditions surrounding the alteration of the original volcanic ash are of great importance in the extent to which the material is susceptible to treatment for enhancing its natural characteristics. Non-swelling bentonites which are responsive to treatment do not seem to have undergone any drastic metamorphism.

3. Activated Montmorillonite Clays

Clays have long been used for the decolorizing of mineral and fatty oils and the large quantity of clay applied to this use has led to attempts to produce more active bleaching products. Certain montmorillonite clays when activated with acid under optimum treating conditions have a markedly increased decolorizing action over the naturally occurring adsorbent and therefore require less material for a given amount of oil bleaching. In recognition of this desirable characteristic, patents were filed in this country by Prutzman[1] and Chappell et al[2] in 1921 covering the activation of clays by leaching with acid. An industry was founded for treating certain montmorillonite clays and the activated products became generally available for commercial uses. Subsequent to the widespread application of these materials as decolorizing adsorbents on mineral and fatty oils, various investigators early noted that under certain conditions the activated clay exhibited catalytic activity.

In 1926, Houdry, while testing catalysts for the conversion of Iraq crude oil, found that a treated aluminum silicate[3] produced a higher grade gasoline; after working out the method for regenerating as well as using the catalyst, he developed a commercially practical process for catalytic cracking employing an activated clay as the catalyst. Other investigators have also studied the use of activated clay as a catalyst, with the result that up to the present time the majority of catalyst sold for commercial cracking has been of the activated montmorillonite type.

Thousands of bentonitic samples have been treated and tested to determine their activity toward petroleum oils, and it has been noted that many bentonites do not activate to any great extent. Engineering and economic considerations have tended to limit the non-swelling bentonitic deposits available as large scale sources of the desirable montmorillonite clay. Since montmorillonite plays an important role in the activity, special attention is given to its molecular structure.

4. Montmorillonite

Montmorillonite may be represented by the ideal formula $Al_2Si_4O_{10}(OH)_2nH_2O$ and has a crystalline rather than an amorphous or gel structure as exemplified by silica gel. The crystal lattice is characterized by a layer configuration[4], each layer consisting of 4 sheets of oxygen as graphically shown (Fig. 2)[5]. Between the outer sheets of the oxygen in the tetrahedral position are located the silica atoms; in the octahedral positions are the aluminum atoms; and in the same oxygen sheets which form the boundaries of the octahedrons are the hydroxyl ions. Through Van der Waal's forces a small number of platelike layers, each separated from the other by a layer of water of hydration, stack up in the *c* axis to form the individual crystals of the clay particles (Fig. 3), and these individual crystals are quite small judging from X-ray photographs.

As mined, activatable bentonites generally contain from 30% to 40% water which is present between the layers of montmorillonite as well as around the crystal surface and this is indicative of the potentially great surface area that can be made available by suitable processing. Certain optimum treatment so highly develops these surface characteristics of the montmorillonitic clay that the adsorptive qualities toward water vapor may be made to equal those of silica gel at relatively high humidities and even to exceed silica gel in the lower humidities.

In nature the ideal formula for montmorillonite is never realized due to substitutions. One substitution that seems to be typical is the partial replacement of aluminum by magnesium[6]. This montmorillonite mutation does not appear to be a hit or miss proposition but characteristically every sixth aluminum ion is supplanted by a magnesium ion and this re-

*Presented before the Petroleum Division, American Chemical Society, Detroit, April 15, 1943.
** Filtrol Corp., Los Angeles.

[1]Prutzman—U. S. Patent 1,397,113.
[2]Chappell et al.—U. S. Patent 1,642,871.
[3]Houdry—U. S. Patent 2,078,945 (1937).
[4]Hofman et al., *Zeit. F. Kryst*, 86, 340, (1933).
[5]Emelius and Anderson, *Modern Aspects of Inorganic Chemistry*, p. 204.
[6]Hendricks, *Journal of Geology*, 50, 276, (1942).

placement of a trivalent cation, aluminum, by a divalent cation, magnesium, gives rise to a deficiency in positive charge. This causes the lattice to become negatively charged and in order to neutralize this charge various types of cations are adsorbed on the crystal protruding into the water of hydration space between the layers of montmorillonite. The cations, being exposed, are subject to mass action effects and are readily replaceable, thus giving rise to the phenomenon of base exchange which is a characteristic of substituted montmorillonite.

Base exchange is familiar in the action of zeolites for the softening of water; however, in zeolites the exchange ions are buried in small tunnels running through the zeolite lattice and are hence inaccessible to larger molecules and unable to significantly alter the surface activity. In contrast to this character of zeolites, the base exchange ions being on the surface of the montmorillonite allow for modification of this surface.

5. Activated Montmorillonite

Modification of the surface of raw montmorillonite is effected by suitable activation. The most common form of activating is by means of acid, and in treating a magnesium substituted montmorillonite for use as a catalyst for conversion of hydrocarbons two main purposes are served: (a) removal of impurities with attendant increase in effective catalytic surface, and (b) replacement of exchangeable ions by hydrogen.

The removal of impurities during activation discards those compounds which blind the catalyst surface or might promote unwanted side reactions; however, the extent of such removal is dependent on the quantity and location of the impurities present in the raw substituted montmorillonite. In addition to removal of impurities, normal activation causes a slight alteration of the montmorillonite layers to produce some hydrated silica although this alteration does not appreciably affect the basic lattice structure. Activation also effects replacement, by hydrogen ions, of the surface cations originally present on the magnesium substituted montmorillonite lattice. Thus the activated material may be termed a magnesium substituted hydrogen montmorillonite.

Explanation of the catalytic action of the activated compound is based on a correlation of its structure with theories of catalysis.

6. Mechanism Of Catalysis

The catalytic conversion of petroleum hydrocarbons by clays is heterogeneous catalysis and is considered to be influenced by the extent of surface and the adsorptive power of the catalyst. The action of an adsorbent may be due to physical, i.e., relatively weak, attraction forces, or it may be due to strong valence chemical forces. Absorbents of this latter type are characterized by an increase in adsorptive power with a rise in temperature, and have high heats of adsorption and large energies of activation. Adsorption is generally considered to precede catalysis because otherwise the time of contact between the catalyst and the reactants would be too short to permit any kind of catalytic mechanism. If this hypothesis is valid, then chemical adsorption will be the type having the most influence in catalysis[7].

Activated montmorillonite, when employed as a decolorizing agent for color stable petroleum oils, shows a characteristic increase in activity with temperature rise and the adsorbed color bodies are strongly held by the clay inasmuch as their subsequent removal therefrom is effected only by drastic treatment. This indicates that activated montmorillonite operates mainly by chemical adsorption. The raw base montmorillonite is relatively inactive as a decolorizing agent exhibiting but one quarter the bleaching power of the activated material with a corresponding decreased affinity for adsorbed color bodies. However, X-ray diffraction pattern pictures of both raw and activated montmorillonite demonstrate that the basic crystal structure is not altered by activation except for the appearance of a diffraction line indicating some formation of hydrated silica. Therefore the chemical adsorption appears to be a function of the surface condition of the activated montmorillonite.

If the extent of surface is measured by physical adsorption, such as reversible water vapor adsorption which is a function of the capillarity and the critical constants of the vapor, it is found to be exceptionally great for both the raw and activated clays but there does not exist anything like the difference between their relative powers that is noted between these materials in a chemical adsorption process. In other words, activation does not seem to effect any drastic change in the actual extent of surface presented by the clay (as measured by water vapor adsorption) but mainly exposes a surface which has increased chemical activity. In addition the activation removes undesirable materials which even in small quantities exert considerable influence on catalytic performance.

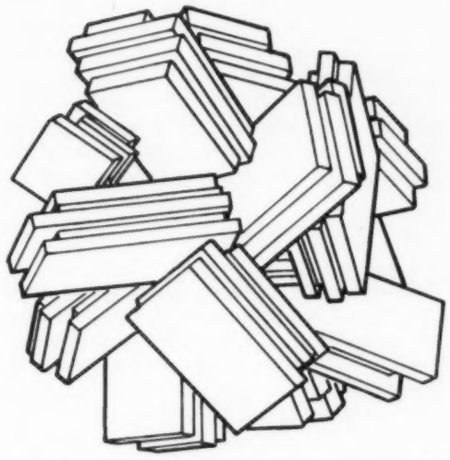

Fig. 3. Clay particle as an aggregation of montmorillonite crystals. The unit montmorillonite cells make up the layers and these layers then stack up to form the montmorillonite crystal

Fig. 2 represents a unit cell of pure montmorillonite and shows the ions contained in each of the four sheets parallel to the plane of the *a b* axes. Fig. 4 is an expansion of Fig. 2 to illustrate a crystal of magnesium substituted montmorillonite when viewed looking down the *c* axis with the atomic sheets lying parallel to the *a b* axes plane cut away successively from left to right. In this plan the oxygens are represented both as circles and as points, the points, or centers of the oxygen atoms, being connected to form the layer of silicon-oxygen tetrahedrons, oxygen-aluminum octahedrons, and then the bottom layer of silicon-oxygen tetrahedrons. The hydroxyl ions on the octahedrons are represented by the hatched circles and it will be seen that these ions rest in the openings between the silicon-oxygen lattice above and below the aluminum-oxygen octahedrons. Also in every third opening on alternate sides of the crystal are the exchanged hydrogen ions.

X-ray measurements[8] reveal that the *a* and *b* plane of the unit cell of the montmorillonite crystal is 8.83 Angstrom units by 5.09 Angstrom units. It will be noted that linearly there are 3 oxygen atoms per crystal so that the oxygen-to-oxygen distance in the octahedron is $\frac{8.83}{3}$ = 2.94 Angstrom units and these oxygens of the octahedrons form the vertices of the tetrahedrons as shown in Fig. 2. However, the oxygen-to-oxygen distance is accurately known to be 2.70 Angstrom units so that, as may be seen from the relative sizes of the circles, the

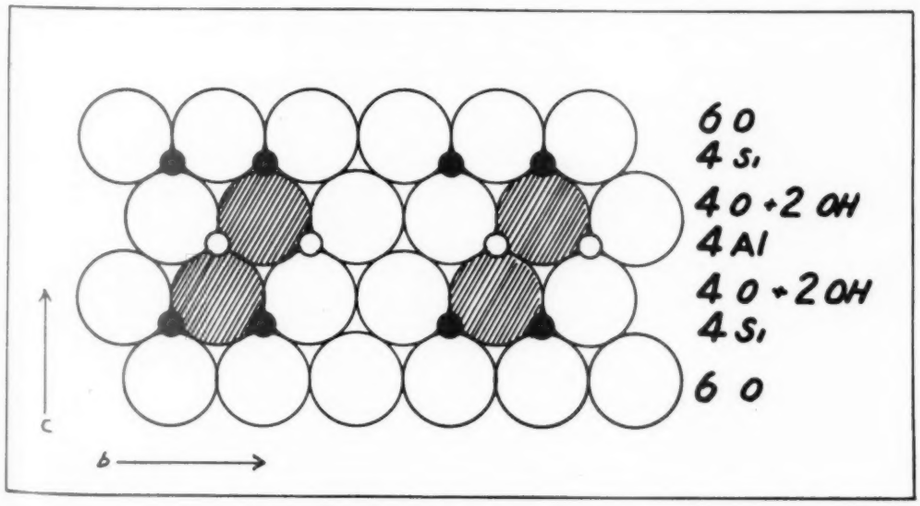

Fig. 2. Distribution of ions in the ideal montmorillonite unit crystal cell

[7]Berkman, Morrell, & Egloff, *Catalysis*, p. 34 and p. 85.

ionic volume of the tetrahedral oxygens must undergo compression while the octahedral oxygen ions must expand in order that the center-to-center oxygen distance will be 2.94 Angstrom units. Under these conditions the distance between centers of the oxygen-oxygen ions in the silicon-oxygen layer—the layer exposed to the hydrocarbons during catalysis—

is seen by Fig. 4 to be $\frac{8.83}{4} \times \frac{2}{\sqrt{3}} = 2.55$

Angstrom units. Within the limits of error of measurement this is exactly the distance between alternate carbons in a carbon chain, i.e., the carbon-to-carbon bond distance is 1.54 Angstrom units but since they are at an angle with each other lying in a zigzag chain giving a distance between alternate carbon atoms of 2.54 Angstrom units.[8]

The montmorillonite lattice has been shown to present an adsorptive surface which has valence forces. If these are considered as emanating from the silicon-oxygen layer, the hydrocarbon approaching this surface at elevated temperatures (temperatures at which the free energies involved in the desired reactions are negative) may enter the fields of force on this outer layer of the catalyst and become sufficiently polarized to be attracted and temporarily held to the surface.

As the distance between centers of the oxygen atoms in the silicon-oxygen layer is the same as the distance between the centers of alternate carbon atoms, there are several assumptions which may be made on the basis of this spatial relationship.

1—The hydrocarbon molecules are adsorbed on the lattice surface with the centers of its alternate carbon atoms in each chain coincident with those oxygen ions (in the silicon-oxygen layer) having a straight line configuration. This could furnish a parallel arrangement as shown in the upper lefthand corner of Fig. 4.

2—Alternatively to the parallel alignment, there are equal chances for adsorption of hydrocarbon molecules in lines forming angles 60° and 120° with each other.

3—The distance between parallel lines of oxygen ions in the silicon-oxygen layer is 4.4 Angstrom units and it has been estimated that, in view of Van der Waal's forces, this is approximately as close as the centers of carbon atoms of two different molecular chains can approach one another without a change in structure. Hence, hydrocarbon molecules adsorbed on these adjacent parallel lines will be held in extremely intimate juxtaposition.

These orientation assumptions provide a basis for a few interesting speculations concerning the mechanism by which the catalytic conversion of petroleum hydrocarbons may take place.

Because of the orientation of the hydrocarbon molecules on the surface of the activated clay, the centers of alternate carbon atoms in any one hydrocarbon are at a minimum distance from the centers of the corresponding oxygen ions in the lattice, and the bonds of the carbon atoms are thus subject to the maximum electrical force exerted by the oxygen ions. Under the physical conditions of the cracking operation this electrical force is thought to be sufficiently strong to dislocate the electronic orbits of some of the carbon atoms, or to change the electron bonds to unstable semi-polar bonds, resulting in cracking of the hydrocarbon chain. If coke formation is considered to be a primary reaction product of cracking, then coke, hydrogen, unsaturates and saturated products will be formed from the original hydrocarbon. As a secondary step, the unsaturates may polymerize to branched chain unsaturates which are hydrogenated by the hydrogen present forming high anti-knock value saturated compounds.

Another possible reaction can be conceived from the adsorption of hydrocarbon chains on adsorption lines forming angles of 60° and 120° with one another, thus furnishing the chance of interference and rupture of the chains at the points of intersection with subsequent reforming into new groups. Similarly reactions may take place across the 4.4 Angstrom unit gap between parallel chains of adsorbed hydrocarbons. If the agitation imparted by heat is great enough to bring the alternate carbon atoms lying above the surface closer together there is a possibility of cross linking yielding branch chain hydrocarbons or double cross linking yielding naphthenics and ultimately some aromatics.

The hydrogen ion which has replaced the exchangeable cation during activation is held by a relatively weak force due to its distance from the complementary magnesium ion. In consequence the hydrogen ion is considered to be an active center and may initiate reactions, for example polymerization.[9]

The hydrocarbons which have been adsorbed and reacted must be desorbed in order to maintain the flow of charge and products. Desorption might be considered due to a combination of two mechanisms, coke formation and energy changes attendant in the hydro-

[8]Gilman, *Organic Chemistry, An Advanced Treatise.*
[9]Whitmore, *Ind. Eng. Chem.*, 26, 94, (1934).

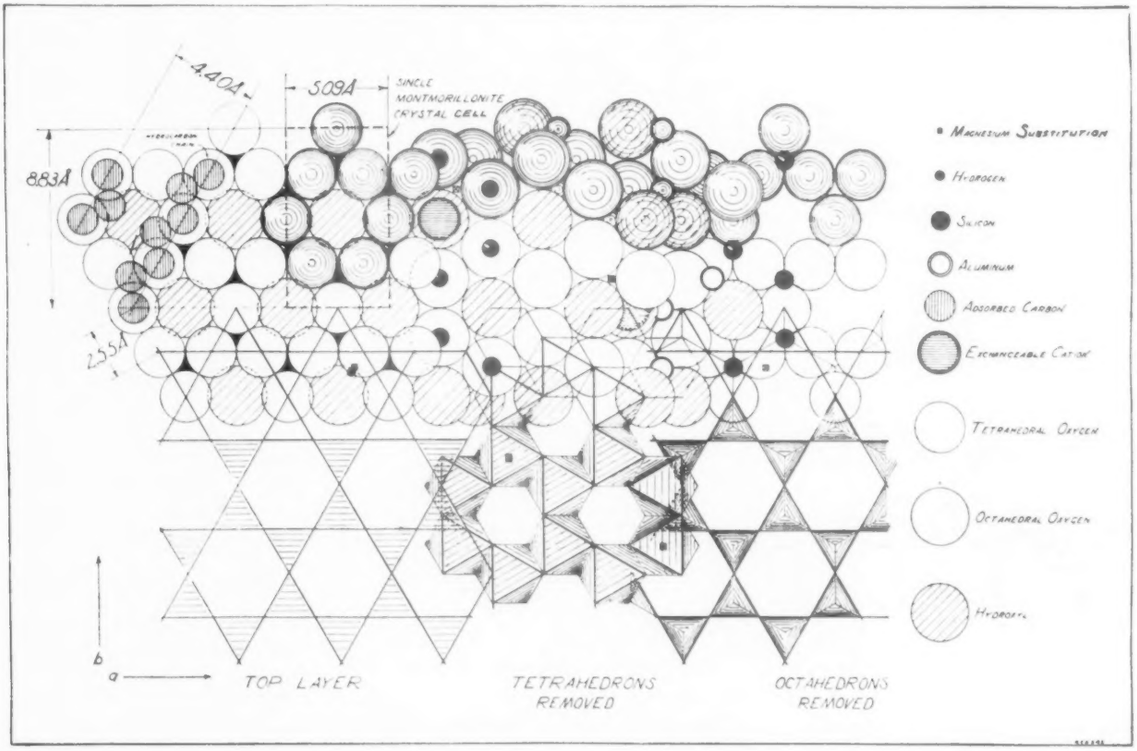

Fig. 4. Theoretical magnesium substituted montmorillonite cut away to show the successive ionic sheets composing the crystal layers

carbon conversion. Coke formation reduces the valence forces of the catalyst lattice ions on which the coke is deposited thus tending to reduce the effective adsorptive forces on the reacted hydrocarbons. In addition, the products of cracking have a lower molecular weight and are largely branched chains so that for a given kinetic energy the internal agitation is increased and the newly formed molecule tends to break away from the forces of adsorption.

In common with many oxide catalysts the activity of activated montmorillonite is seriously affected by complete dehydration. If such dehydration is considered to be removal of water derived from the structural hydroxyl ions it is obvious that the montmorillonite configuration is destroyed.

7. Relationship Between Activation And Catalytic Activity

The study of application of activated clay to catalysis has shown that the purity of the raw montmorillonite and variation in its activation exert a marked effect on the catalytic activity of the final product. Table I lists the gas oil conversion efficiency of one raw montmorillonite and the efficiency of this same clay after activation in 5 different ways; also given are the efficiencies of these montmorillonites with respect to their ability to decolorize cylinder stock in a high temperature contacting operation.

Table I

Mont.	Activation Treatment	Catalytic Efficiency	See footnote (*)
Raw	None	24%	25%
Activated	A	83%	72%
Activated	B	100%	98%
Activated	C	115%	93%
Activated	D	124%	109%
Activated	E + F	133%	86%

*Decolorization efficiency as % color removed compared to std. as 100%.

These data indicate that the nature of the treatment may affect the catalytic and decolorizing efficiency of the montmorillonite differently and also point out that the activation may be varied to suit a particular need.

Concerning the product distribution in the cracked distillate, it may be stated in general that, for given conditions, the greater the conversion efficiency of the catalyst, the greater the yield of desirable hydrocarbons in the isoparaffin class, both in the finished gasoline and in the gases.

8. Catalytic Cracking Processes

The activated montmorillonite may be employed in a variety of physical forms depending on the characteristics of the process in which it is used. Up to the present time two main physical types have been developed, namely, the pelleted type and the pulverized type. The applications are as follows:

Granular or pelleted catalysts

The Houdry process obtains the conversion by passing gas oil vapors for a short time period through a static bed of catalyst in large cases. Regeneration, i.e., burning the coke off the catalyst, takes place by cutting off the flow of hydrocarbon vapors, exhausting the case, and then blowing with air (Fig. 5). The circulation of molten salts is used to control the temperature during regeneration.

The Thermofor Catalytic Cracking method charges the gas oil vapors countercurrently to a moving body of catalyst in the reactor. Regeneration is made in separate equipment, the Thermofor kiln. The circulation of molten salts controls the temperature during regeneration. Conveyors and elevators carry the catalyst from the reactor to the regenerator and back after the regeneration (Fig. 6).

Fluid type catalysts

A process using the catalyst in a finely divided state, substantially all of it passing a 100-mesh screen, is known as a "fluid" process because the catalyst is borne concurrently by the gas oil vapors during the time of reaction. After reaction the catalyst is taken out of the stream by cyclone separators, or some other suitable means, and charged to the regeneration system (See pg. R-251, June 2, 1943, Technical Section NPN for flow diagram of Fluid Catalyst Cracking Process.)

General

Note that the above processes employ admixtures of the catalyst with the oil vapors by using a fixed bed, countercurrent flow and concurrent flow, respectively. The method of contacting the catalyst with the oil vapor is then the fundamental difference between the 3 processes. In addition the means of altering any or all of the following factors—time of reaction, temperature of reaction, and clay/oil ratio—is different in each process, allowing for variation of conversion and product distribution.

9. Other Applications

The following list represents some of the typical reactions for which activated montmorillonite has been advocated as a catalyst.

(a) Catalytic Cracking
(b) Polymerization
(c) Dehydrohalogenation
(d) Alkylation
(e) Hydrogenation
(f) Dehydration
(g) Isomerization
(h) Toluene production

10. Conclusion

The correlation between the activity of treated montmorillonite and its molecular structure leads to some interesting speculations as to the possible explanations of its catalytic action.

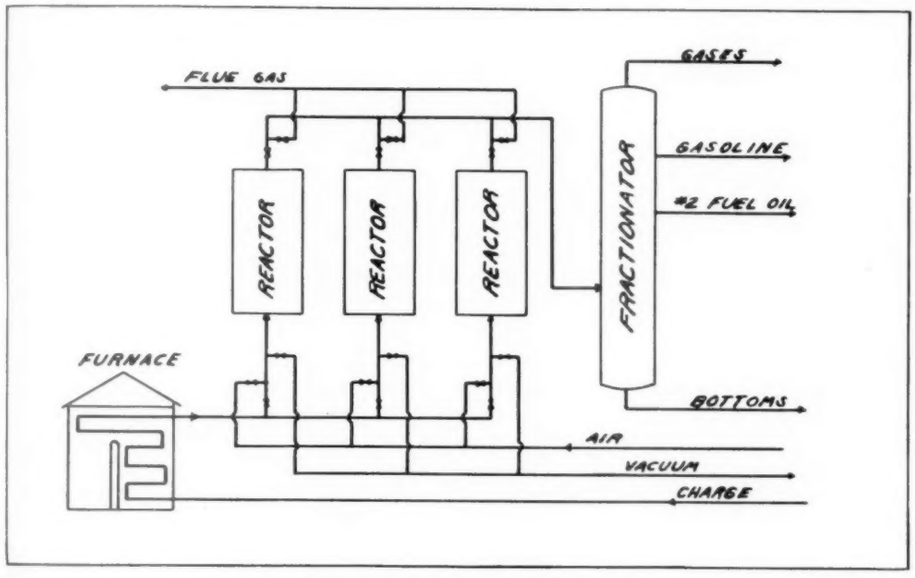

Fig. 5. Flow diagram of Houdry Catalytic Cracking process

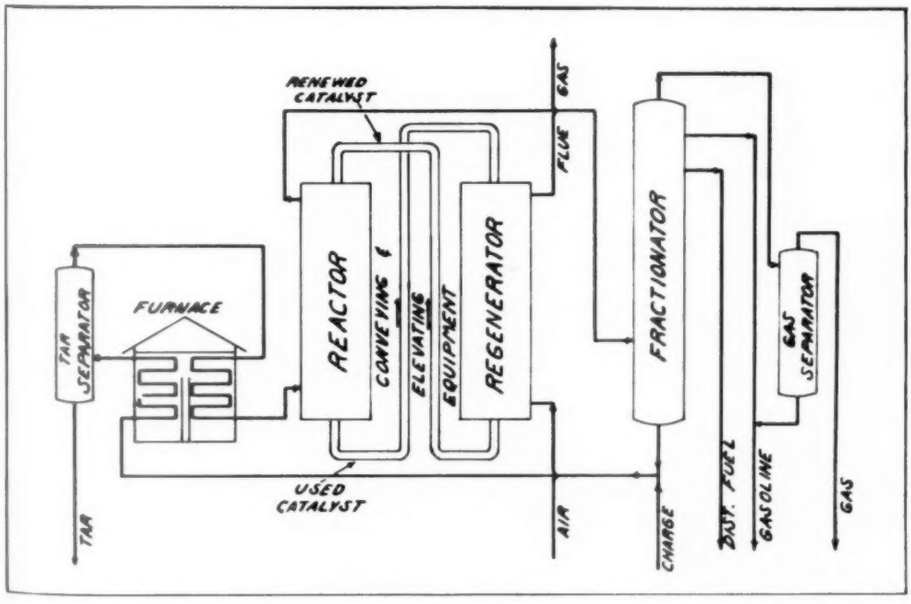

Fig. 6. Flow diagram of Thermofor Catalytic Cracking process

The Effect of Catalysts

In Vapor Phase Cracking*

720.3
721.5

By P. P. Borisov and M. V. Gaverdovskaya**

Vapor phase cracking of a 300-400 deg. C. oil fraction at 500 deg. C. in the presence of 4 catalysts revealed that the efficiency in gasoline formation increased in the following order: zinc oxide, nickel-alumina, activated carbon, nickel oxide; in the presence of the last mentioned catalyst, 38% gasoline was obtained against 18% formed in non-catalytic cracking under identical conditions. Nickel-alumina gave the largest amount of gas and the highest extent of unsaturation.

Similar cracking of a kerosine fraction (200-300 deg. C.) consisting of 40% naphthenes and 60% paraffins in the presence of 13 catalysts showed that in the presence of ferric oxide, borax, glass chips, manganese dioxide, titanium dioxide, metallic nickel and uranium oxide the proportion of gasoline to kerosine obtained varied from 1:3 to 1:3.5 and the gas formation was low. Zinc oxide and activated carbon produced more gas than gasoline or kerosine. Uranyl oxide and thorium oxide gave the lowest amounts of gas and the highest yields of gasoline, which was 41.1% in the case of thorium dioxide.

The predominant reaction occurring in these cracking experiments is thought to be dehydrogenation of naphthenes and decomposition of paraffins, as shown by tests with hexane and cyclohexanes.

The numerous observations on the pyrogenetic reactions in the presence of catalysts did not result in any uniform view on their effect.

Dehydrogenation of oil fractions was stated to take place in the presence of manganese dioxide, potassium permanganate, oxides of zirconium and zinc[1,2]*; dehydrogenation and decomposition of heavy hydrocarbons—on aluminum oxide, zinc chloride, magnesium chloride, unslaked lime, ferric sulfide, antimony sulfide, potash, calcium chloride and nickel carbonyl. In all cases, a positive effect of the catalysts was established, but their rapid poisoning was noted, due to decomposition of carbon on their surfaces*[4,5]*. The present article reports results of cracking experiments in the presence of a number of catalysts.*

Solar oil was used as a charging stock in the first part of this work. It was dried over sodium sulphate and distilled. The fraction 300-400 deg. of d(15/25) 0.887 was used in the experiments. In each experiment, 500 g. oil were cracked, the liquid condensate was dried with calcium chloride and distilled into a fraction with end point 200 deg. C., a second fraction boiling within 200 to 300 deg. C. and a residue boiling over 300 deg. C. The gaseous part was measured, sampled and burned in a burner attached at the end of the experimental unit.

Every hour from the beginning of the experiment, 250 cc. samples were taken; the gas was analyzed by the Hempel method. The gasoline and kerosine fractions, as well as the gas and its contents of hydrogen and unsaturated hydrocarbon, indicated the action of the catalyst as compared with the results of experiments without catalysts in the same apparatus. Activated carbon, nickel oxide, nickel on alumina and zinc oxide were used as catalysts.

The apparatus[6] consisted of a metallic circulation system including a Heraus furnace 77 cm. long. The contact tube ended in a U-tube from which the light distillate passed into a condenser and receiver, the gases passing through a gas meter; the heavier distillate was returned to the still and again cracked. The contact mass formed in the reaction tube a 200 mm. layer of 15 mm. diameter. The catalysts were in all cases pressed into the shape of small sausages. In addition to the volume, the temperature was also kept uniformly at 500 deg. C. The rate of flow was 1 cc. per minute, and this insured a practically uniform duration of contact of the vapors of the cracking charge with the contact mass. The results given in Table 1 show differences ascribed to the difference in the chemical nature of the catalysts.

Nickel on alumina is seen to exert the most severe cracking effect, producing more gaseous products than other catalysts. The least effect is shown by carbon. Nickel oxide gave the largest yield of light fractions (38.0%). The highest content of unsaturated compounds in the gas results from the use of zinc oxide. Since the object of these experiments consisted first of all in the determination of the effect of the catalysts on the process in general, determination of the relative amounts of gasoline and kerosine and of gaseous products constituted the basic characteristics of this effect, and the catalyst producing the lowest amount of gas and the highest amount of gasoline was naturally of more interest. In Table 1, the catalysts are given in the order of their activity shown by the yields of light gasoline.

The chemical effect of the catalysts was further investigated in experiments with kerosine from which the unsaturated and aromatic hydrocarbons were previously removed by treatment with sulfuric acid containing 3% sulfur trioxide, drying and distillation to produce a fraction boiling within 200 and 300 deg. C. This fraction was shown by the aniline point analysis[7] to contain 40% naphthenes and 60% paraffins. The experiments were carried out in the same 77 cm. long furnace in which the catalyst occupied 20 cm. The temperature was kept at 500 deg. C. and the rate of flow, at 1 cc per minute. The effect of the various catalysts tested in this series of experiments is shown in Table 2 to greatly differ, the yields of gasoline being within 7.8 and 41.1%. The yields of kerosine differed accordingly. The formation of gaseous products was not directly dependent upon the yield of gasoline and also showed great fluctuations within 6.7 and 44.5%.

A detailed inspection of the data shows that some contact bodies exerted almost no action on the yield of gasoline and kerosine or, more correctly, on their proportion, which varied from 1:3 to 1:3.5. This group (group 1) includes ferric oxide, borax, glass, manganese dioxide, titanium oxide, metallic nickel and uranium oxide. These catalysts are also characterized by formation of relatively little gas, in most cases lower than the yield of gasoline.

Zinc oxide sharply differs from the above group of catalysts; the yield of gaseous products of cracking exceeded in its presence not only the yield of gasoline but also that of kerosine. Both types of activated carbon belong to the same category, as they gave similar results with the only difference that the gasoline fraction was larger than the kerosine, while in the case of zinc oxide, the kerosine fraction was almost twice as large as the gasoline fraction. These three catalysts comprise the group 2.

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* From "Scientific Reports of the Moscow State University", Vol. 3, pgs. 233-238, 1934; "Neftyanoe Khozyaistvo" (The Petroleum Industry) Vol. 26, No. 10, pgs. 37-39, 1934.

This is a complete translation of the original article except for sections of apparently minor importance set in italics.

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** Laboratory of Organic Chemistry, Moscow State University.

Effect of Catalysts in Vapor Phase Cracking

The group 3 of catalysts produced large yields of gasoline and low yields of gaseous products. It consists of uranyl oxide and thorium oxide. The first is of special interest and perfectly identical results were obtained with it in ten consecutive experiments, indicating its prolonged activity. This catalyst is also of interest from the point of view of the composition of the gasoline fraction as shown below. Thorium oxide differs from all catalysts studied with respect to the yield of gasoline, which reached in its presence 41.1%. Aluminum oxide showed the weakest action, in which respect it approached the catalysts of group 1.

Concerning the composition of the products, it is noted that all catalysts tested produce a considerable percentage of aromatics in the gasoline, as well as in the kerosine fractions. In some cases, for instance in the presence of uranium oxides, almost half of the gasoline and a third of the kerosine fractions consisted of aromatics. The gasoline fraction contained very little unsaturated compounds. The oil fractions obtained in the presence of thorium oxide, titanium oxide and borax approach those obtained by cracking over oxides of uranium with respect to their composition. In the presence of the other catalysts, a lower content of aromatics and a higher content of unsaturated were produced, for which reason they are thought to be of lower interest. When the catalysts are considered from the point of view of the yields of gasoline and kerosine, they may again be divided into two groups, the first consisting of oxides of uranium, thorium and titanium and the second comprising all the other catalysts, the use of which is less advantageous.

It was of interest to study the conversion of individual hydrocarbons in the presence of uranyl oxide in experiments under the same conditions as employed with kerosine. Hexane, cyclohexane, methylcyclohexane and dimethylcyclohexane were used in these experiments, the data of which are shown in Table 3.

A marked dehydrogenation of all hydrocarbons is seen to take place, and it is of special interest that cycloolefins formed from methylcyclohexane and dimethylcyclohexane underwent no irreversible catalytic conversion, i.e., formation of aromatics and cyclohexanes, which is usually observed in their dehydrogenation in the presence of a number of other catalysts, particularly nickel on alumina[8].

As was expected from the similarity of the chemical nature of cyclohexane, methylcyclohexane and dimethylcyclohexane, their cracking under identical conditions gave identical results within the limits of experimental error. Essentially different was the behavior of hexane. Considerably less unsaturates were formed in the gasoline fraction resulting from its conversion. The amount of aromatics was also lower, but the amount of gaseous products considerably higher (16.5 liters per 100 g. charge, instead of 5-6 liters obtained from cycloparaffins). This points to destructive processes that do not occur in the case of cycloparaffins.

The analysis of the gas from cracking of these hydrocarbons, together with the data on the composition of the condensate indicates the nature of the reactions as determined by the chemical composition of the starting material. Since the gas obtained from cracking hexane contains considerable unsaturated hydrocarbons, 11.3%, and very little hydrogen, while the gas resulting from cyclohexane was practically free of unsaturated hydrocarbons (0.5%, possibly an error in the determination due to the method used) and contains much (45.2%) hydrogen, it is evident that the basic reaction in the case of cyclohexanes was dehydrogenation followed by decomposition of the molecule. The unsaturated hydrocarbons formed in the reaction are partly hydrogenated, as indicated by the low content of unsaturated in the gas.

Since the rate of flow of the substance was high, neither of these processes was completed. In the case of hexane, and possibly straight chain hydrocarbons in general, far-reaching decomposition is the basic reaction.

Formation of aromatics may be considered as a secondary process of polymerization of acetylenes and polymerization of olefins, followed by dehydrogenation. This view is also borne out by the reported analytical data for the gas.

The study is thought to indicate that catalysts may be found promoting cracking for a prolonged period of time as does uranyl oxide.

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Table 1—Cracking of Solar Oil (300-400 deg.)

		Catalyst: no catalyst	zinc oxide	nickel on alumina	activated carbon	nickel oxide
Fraction %	to 200 deg.	18.2	20.4	26.1	27.3	38.0
	200-300 deg.	40.4	30.1	20.2	47.4	22.1
	over 300 deg.	15.0	9.0	0.0	10.0	2.0
Gas and losses		26.4	38.5	53.7	15.3	37.7
Analysis of gasoline with end point 200 deg., %	unsaturated	30.0	47.7	70.7	68.0	71.0
	aromatics	45.0	6.1	14.7	9.2	10.0
	naphthenes and paraffins	25.0	45.9	15.3	12.8	19.0
Analysis of the gas, %	hydrogen	16.3	10.4	27.1	8.0	8.5
	unsaturated	58.6	69.2	57.5	36.3	33.1

Table 2—Cracking of Kerosene (200-300 deg.)

Number	Catalyst	Distillate, % to 200 deg.	Distillate, % 200-300 deg.	Gas and losses	Fraction with end point 200 deg., % aromatics	Fraction with end point 200 deg., % unsaturated	Fraction 200-300 deg., % aromatics	Fraction 200-300 deg., % unsaturated
1	no catalyst	7.8	85.5	6.7	21.8	25.2	9.0	7.5
2	aluminum oxide	16.1	75.0	8.9	29.7	23.4	15.2	13.1
3	iron oxide	19.4	63.9	16.7	36.0	14.1	20.1	16.3
4	zinc oxide	19.4	36.1	44.5	30.1	15.7	11.4	19.1
5	calcined borax	20.0	68.3	11.7	43.5	4.9	12.5	5.3
6	glass chips	20.0	69.1	10.9	36.0	8.8	16.6	7.0
7	manganese dioxide	20.5	60.0	19.5	29.3	17.0	15.0	11.2
8	titanium oxide	21.9	63.9	14.2	40.0	8.2	25.7	13.2
9	nickel wire	22.2	63.9	13.9	31.7	9.8	14.0	7.2
10	uranium oxide	22.2	63.7	15.1	48.7	7.0	33.9	12.3
11	uranyl oxide*	26.4	63.9	9.7	48.2	7.7	36.7	15.0
12	activated carbon (from fruit pits)	32.2	29.4	38.4	20.6	20.5	9.1	15.0
13	activated carbon (Kahlbaum)	33.8	24.4	41.8	24.9	19.5	12.5	15.3
14	thorium oxide	41.1	47.7	11.2	41.5	13.9	9.9	8.3
15	uranyl oxide*	ten consecutive experiments gave the same results as in experiment 11.						

* This is termed by the authors "uranous—uranic oxides"—Trans.

Table 3—Conversion of Individual Hydrocarbons Over Uranyl Oxide*

Fraction		Hexane to 120 deg.	Cyclohexane to 100 deg.	Methylcyclohexane to 127 deg.	Dimethylcyclohexane to 130 deg.
Charge, g		30	100	100	100
Products obtained, g		25	94	91	93
Liters gas obtained		5	6	5	3
Analysis of the liquid product	unsaturated, %	0.2	6.6	9.1	6.3
	aromatics, %	4.6	9.0	9.1	7.2
	Naphthenes and paraffins, %	95.0	84.4	81.8	86.5
Analysis of the gas	unsaturated, %	11.3	0.5	0.9	0.7
	hydrogen, %	2.5	45.2	40.1	35.5
	paraffins, %	80.1	54.0	58.8	63.0
d(15/15)	before treatment with sulfuric acid	0.6822	0.8558	0.7952	0.7778
	after treatment with sulfuric acid	0.6784	0.7828	0.7680	0.7720

* This is termed by the authors "uranous—uranic oxides"—Trans.

Cutting Fluid Recommendations For the New Wartime Metals

CUTTING fluid recommendations based on the steels and non-ferrous metals available today are contained in the report of a special research committee of the American Society of Tool Engineers which included oil company representatives*.

The report includes a table showing the type of cutting fluid for various machining operations for 6 groups of metals based upon normal operating speeds, tool life and finish. The metals are grouped by their machinability ratings, as compared with a 100% machinability rating for A.I.S.I. American Iron and Steel Institute) Steel Specifications B-1112, cold rolled or cold drawn when machined with a suitable cutting fluid at 180 ft. per minute under normal cutting conditions.

Group 1 includes ferrous metals which have a rating of 70% or over based on 100% rating for B-1112 steel. Group 2 includes ferrous metals having a rating of 50 to 75%. Eleven grades of the National Emergency steels are in this group. Group 3 includes ferrous metals with a rating of 40 to 50% and Group 4 below 40%. (Three grades of NE steels with the higher amounts of chromium, manganese and molybdenum are in Group 3.) Group 5, non-ferrous, includes metals with a rating of over 100% as compared with B-1112 steel and Group 6 those non-ferrous metals (bronze, copper, nickel and Monel Metal) with a rating below 100%. A condensed version of the cutting fluid recommendation chart contained in the report is given below.

"Cutting fluids are one of the essential tools used in the machine production of metal parts," said William H. Oldacre, Chicago, president of the D. A. Stuart Oil Co., a member of the research committee. "As is the case with other tools, considerable skill and experience is required to manufacture and apply them efficiently. Wartime demands for high quality output emphasizes the need for a more thorough study and better understanding of the part the cutting fluid tool plays in the overall production picture.

"The machining qualities of steel have been greatly improved; great advances have been made in the production of materials for the cutting edge. Rugged and intricate machine tools have been developed. Improved lubricants and cutting fluids are available. The correlation of these essential factors offers outstanding opportunities for increasing efficiency in metal working production."

H. L. Moir, Chicago, assistant chief products engineer, Pure Oil Co., the other oil man on the committee, said: "The report is of timely significance because it gives the machine tool operator a machinability classification of the new National Emergency steels.

"Many companies are now engaged in metal fabrication who were formerly not even remotely connected with metal working. The specifications chart will familiarize them with the proper recommendations of cutting fluids for the metals used in the individual operation."

The following are among the general cutting fluid recommendations contained in the report to the tool engineers' society:

Mineral-lard oil and sulfurized oil mixtures of low sulphur percentage are generally interchangeable.

Sulphurized oils have a tendency to stain certain non-ferrous metals, such as copper and its alloys.

Carbon tetrachloride, chloroform and certain other volatile solvents should not be added to cutting fluids, as harmful physical effects might follow.

In machining aluminum, quite often cutting oils are diluted with kerosine or mineral seal oil with satisfactory results. Kerosine, up to 15%, is frequently added to emulsions to improve the surface quality of machined aluminum.

Magnesium and its alloys are usually machined with mineral seal oil except where it is possible to machine dry.

In machining brass, which shows no change in cutting pressures with various cutting fluids, it is advisable to apply a cutting fluid to function as a lubricant. Inasmuch as most free-cutting brass is machined in automatic screw machines, an oil is advisable to lubricate the moving parts of the machine. A paraffin or light mineral oil may suffice, or the mineral oil blended with 10% fatty oil may be used to advantage.

In turning Monel Metal it has been found that an emulsion gives a slightly longer tool life than sulfurized mineral oil.

In general, cutting fluids should be applied in large quantities at the highest velocity possible without splashing, directly onto the tool point where the chip is being formed. From 3 to 5 gal. for each single-point tool is most effective. Particularly when carbide tools are used the cutting fluid should flood the tool before the start of the cut and be applied continuously during the cut. The use of sulfurized oils on carbide tools is reported injurious to the tools.

For satisfactory tool life, temperature of the cutting fluid should not be permitted to exceed 110 deg. F.

On high-speed operations, cooling is more important than lubrication, inasmuch as the speed itself usually provides good surface quality. On low speeds where the segmental or discontinuous type of chip is formed, the face of the tool may be periodically lubricated so oils, and particularly a sulfurized oil for threading and broaching are desirable.

*Report of Independent Research Committee on Cutting Fluids, of the American Society of Tool Engineers, Inc., 2567 W. Grand Blvd., Detroit.

Cutting fluid recommendations for various machining operations for each of 6 groups of metals based upon normal operating speeds, tool life, and finish

Type of Operation Severity (1 = Greatest, 10 = Least)	Groups of Metals Based on Class of Machinability Ratings																				
	1. Ferrous Over 70%			2. Ferrous 50 - 70%			3. Ferrous 40 - 50%			4. Ferrous Below 40%			5. Non-Ferrous Over 100%			6. Non-Ferrous Below 100%				
1. Broaching—Internal	Em.	Sulf.		Sulf.	Em.		**Sulf.**	Em.		**Sulf.**	Em.		MO.	Em.		Sulf.	ML.			
2. Broaching—Surface	Em.	Sulf.		**Em.**	Sulf.		**Sulf.**	Em.		**Sulf.**	Em.		MO.	Em.		Sulf.	ML.			
3. Tapping—Plain	Sulf.			Sulf.			Sulf.			Sulf.			Em.	Dry		Sulf.	ML.			
2. Threading—Pipe	Sulf.			**Sulf.**	ML.		Sulf.			Sulf.						Sulf.				
3. Threading—Plain	Sulf.			Sulf.			Sulf.			Sulf.			Em.	Sulf.		Sulf.				
4. Gear Shaving	Sulf.	L.		Sulf.	L.		Sulf.	L.		Sulf.	L.									
4. Reaming—Plain	ML.	Sulf.		ML.	Sulf.		ML.	Sulf.		ML.	Sulf.		ML.	MO.	Em.	ML.	MO.	Sulf.		
4. Gear Cutting	Sulf.	ML.	Em.	Sulf.			Sulf.			Sulf.	ML.					Sulf.	ML.			
5. Drilling—Deep	**Em.**	ML.		Sulf.	**Em.**		Sulf.			Sulf.			MO.	ML.	Em.	Sulf.	ML.			
6. Milling—Plain	**Em.**	ML.	Sulf.	Em.			Em.			Sulf.			Em.	MO.	Dry	Sulf.	Em.			
6. Milling—Multiple Cutter	ML.			Sulf.			Sulf.			**Sulf.**	ML.		Em.	MO.	Dry	**Sulf.**	Em.			
7. Boring—Multiple Head	**Sulf.**	Em.		**Sulf.**	Em.		**Sulf.**	Em.		Sulf.	Em.		K.	Dry	Em.	Sulf.	Em.			
7. Multiple Spindle Automatic Screw Machines & Turret Lathes	Sulf.	Em.	ML.	Sulf.	Em.	ML.	Sulf.	Em.	ML.	Sulf.	ML.	Em.	Em.	Dry	ML.	Sulf.				
8. High Speed, Light Feed Automatic Screw Machines	Sulf.	Em.	ML.	Sulf.	Em.	ML.	Sulf.	Em.	ML.	Sulf.	ML.	Em.	Em.	Dry	ML.	Sulf.				
9. Drilling	Em.			Em.			Em.			Em.	Sulf.		Em.	Dry		Em.				
9. Planing, Shaping	**Em.**	Sulf.	ML.	**Em.**	Sulf.	ML.	Sulf.	**Em.**		**Em.**	Sulf.		Em.	Dry		Em.				
9. Turning—Single Point Tool Form Tools	Em.	Sulf.	ML.	Em.	Sulf.	ML.	Em.	Sulf.	ML.	Em.	Sulf.	ML.	Em.	Dry	ML.	Em.	Sulf.			
10. Sawing—Circular, Hack	Sulf.	ML.	Em.	Sulf.	Em.	ML.	Sulf.	Em.	ML.	Sulf.	Em.	ML.	Dry	MO.	Em.	Sulf.	Em.	MI		
Grinding—																				
(a) Plain	Em.			Em.			Em.			Em.			Em.			Em.				
(b) Form (Thread, etc.)		Sulf.			Sulf.			Sulf.			Sulf.			MO.	Sulf.		Sulf.			

Key to symbols for cutting fluids: K—kerosine, L—lard oils, MO—mineral oils, ML—mineral-lard oil, Sulf—sulfurized oils, Em—soluble or emulsifiable oils and compounds, Dry—no cutting fluid.

RUBBER FROM FARM CROPS

Wartime Emergency has Stimulated Development Work to Find Means for Supplying Synthetic Product from Grains and Vegetables and to Find New Latex-Bearing Plants that will Be Economic

THE extent to which research and experimental work is being carried on to find means for supplying synthetic rubber from other sources than petroleum was brought out in papers presented and discussions taking place at the recent Ninth Annual Chemurgic Conference.

There was also reported to the conference the results of study into the derivation of natural rubber from many domestic and imported latex-bearing plants, for the purpose of making new agricultural sources available as early as possible. While it is generally agreed that only small supplementary supplies of natural rubber can be expected from the western hemisphere for the duration of the war, one authority stated that agricultural products such as milk, vegetable oils, turpentine and alcohol are destined to play an important part in the synthesis of rubber substitutes.

While petroleum continues the main source of supply of synthetic rubber in the present government program, the research work to find other means of supply is as important to petroleum technologists as to those in other fields. Such developments in the use of agricultural products as agents in the synthesis of rubber substitutes from petroleum, and as themselves sources of supply of synthetic rubbers are reviewed here as presented at the Chemurgic Conference.

Many oil company technologists will recall the current Chemurgic Conference, held in Chicago March 24, as a development of the annual conferences of the National Farm Chemurgic Council, which was organized in 1935 to study the means for conversion of organic products of the soil into raw materials useful in industry. One of its early programs was the promotion of the manufacture of alcohol from agricultural produce for use as motor fuel.

From "Agripol—the Latest Chemurgic Infant", by Andrew J. Snyder, Reichold Chemicals Inc.

This company is making a Norepol rubber-like product under the name of Agripol. It was stated that the War Production Board has defined Norepol, the process for making which was developed in the Northern Regional Laboratory of the Department of Agriculture at Peoria, Ill., as follows:

"A product capable of replacing rubber or reclaim for essential war or civilian use as approved by the WPB, comprising the reaction product of polyhydric alcohols with polymerized vegetable oils, acids, or their derivatives from which the monomeric acids have been substantially removed."

Reichold Chemicals, a manufacturer of synthetic resins, became interested in the process in July, 1942, and has a present capacity for making Agripol of 2,000,000 pounds per month, which is to be increased to 4,000,000 pounds if raw materials are allocated for that purpose. It was said that, if the WPB grants the materials, the company can bring its annual production to a minimum rate of 50,000,000 pounds by the end of 1943. A general outline of the process was given as follows:

"The principal raw material employed in the production of Agripol comes from the American farm—usually soyabean oil. Other vegetables can also be used. In addition to the oil, a small amount of an alcohol derivative, also a farm product is required. A certain fraction of the vegetable oil fatty acids are combined with a glycol to give what are termed esterized fatty acids or a polyester. This polyester, in turn, is compounded with small amounts of carbon black, zinc oxide, sulfur and a rubber accelerator in the presence of heat. This reaction produces a spongy product. In case a white material is desired, the carbon black is substituted by titanium oxide.

"This spongy product is now ready to be turned over to the rubber compounder, who adds the customary materials for natural rubber compounding, such as sulphur, carbon black, zinc oxide, accelerators, plasticizers, etc. The Agripol has a very fortunate property in that it is adaptable for fabrication on the present rubber equipment. The vulcanizing time and temperature are the same as for natural rubber It can be worked on existing rolls and formed in existing rubber molding equipment. The same statement cannot be applied for most of the synthetic rubbers in use today.

"In regard to the uses for Agripol, the question is asked, 'Is it suitable for making tires?' My present reply is 'No'. However, we have recently requested permission of the WPB to make a set of tires in order that we could have some idea of how Agripol would behave when made into tires. We know that it does not have the tear and abrasion resistance at the present time to give a satisfactory automobile tire. Nevertheless, we feel that with the progress that has been made since last July, it may still have possibilities for recapping or even tires.

Withstands Low Temperatures

"However, the use of Agripol in the field of static rubber has many possibilities not only now but after the war is over. For example, long tests have shown that this product is equal to, or better than, natural rubber at low temperatures such as —40 deg. F. It is much superior to natural rubber in oxygen and ozone characteristics, in fact the quality improves when exposed to either oxygen or ozone. The dielectric strength and corona resistance of Agripol is also an outstanding characteristic, being better than that of rubber. It is impervious to water and alcohol. Its resistance to oil, fuel and organic solvents is very similar to that of the natural rubber.

"The largest outlet for Agripol at the present is in the field of gaskets for food closures. In the same category we have industrial gaskets of all kinds. Due to its electrical properties it makes an exceptionally good wire coating. Other large uses are for hose lining, proof goods, adhesives, sponge rubber and as an extender for natural, reclaim and synthetic rubber. Due to its many rubber-like characteristics, it can also be used for molded and extruded products. Agripol can also be produced and used in the form of an emulsion; here also behaving like rubber."

From "Chemurgic Rubber", presented by Dr. Paul J. Kolechov, technical counsellor, Joseph E. Seagram & Sons, Inc., Louisville.

This company's program in developing synthetic rubber was stated as follows:

"Our organization's interest in synthetic rubber production has been confined to grain only. Three routes have been proposed for synthetic rubber production from grain;

through Butyl Alcohol
through Ethyl Alcohol
through 2-3 Butylene Glycol.

"Our plant's efforts have been concentrated on the glycol process because a careful comparison of the three processes has revealed the following points:

"One bushel of corn (16% starch wet basis and 12% moisture) will yield in butadiene;

2.09 lbs. by the butyl alcohol process
5.80 lbs. by the ethyl alcohol process
7.50-8 lbs. by the butylene glycol process.

"Assuming that the 8-lbs. yield by the butylene glycol process is 100% efficient, then the ethyl alcohol process is 73% and the butyl alcohol process 26% as efficient. Furthermore, the purity of the butadiene produced is scaled in about the same order. The glycol process is the only process, grain or petroleum, that will deliver 98.5% pure crude butadiene from the converter.

"The post-war survival power of this process is increased by the fact that butylene glycol, produced from farm crops, will be a new chemical with potentially many uses."

This company's development work with latex-bearing plants as possible sources for natural rubber was said to have been confined to the Russian dandelion, Kok-saghyz. The paper stated on this phase of the program;

"This plant, which may be called the goodwill ambassador of the fields, offers a great promise to American agriculture, for it can be grown in at least 40 of the 48 states, whereas Guayule (a desert plant native to Mexico) is limited apparently to the soil and climatic conditions of the southwest and Cryptostegia (a shrub of the milkweed family) is confined to Florida and the Gulf Coast. Since we are interested in a reliable and constant supply of natural rubber, this extension to other areas of the country with all their varied seasonal conditions will minimize the chances of crop failure. Kok-saghyz is planted and harvested within one crop year, whereas Guayule takes

4 in order to produce a substantial crop. Like Guayule, Kok-saghyz lends itself to machine methods of planting, cultivation and harvesting. Also, valuable by-products from it are being utilized."

This paper criticized the Baruch Committee as failing to give sufficient thought and study to the natural rubber program. Their statements on this phase of the problem were said to reveal lack of adequate information as well as some absence of foresight. "The natural rubber program still is much confused and is in need of thorough investigation," it was said. "This should be followed by definite recommendations by an impartial committee whose function would be to advise on all the potentialities and the possibilities of producing American agricultural rubber."

From "Rubber from New Domestic Sources", by Dr. H. L. Trumbull, Assistant to Director of Research, B. F. Goodrich Co.

"The commercial production of synthetic polymers requires many products of agricultural origin. For example, the present butadiene program for G.R.S. synthetic rubber contemplates that one-third of the butadiene production of 650,000 tons will be based upon alcohol. The G.R.S. program requires large tonnages of soaps which are derived from animal and vegetable fats and oils.

"Soybean oil has been converted by the Northern Regional Laboratory (of U. S. Department of Agriculture) into a polymer with rubbery properties, called Norepol. The fabrication of commercial products closely resembling Norepol in properties is evidence of the industrial interest in these new polymers derived from vegetable oils. Molded and extruded articles formerly made from natural rubber have been made successfully from such materials.

"The recovery of lactic acid from whey represents an interesting current development, since from lactic acid can be derived certain monomers employed in the manufacture of synthetic rubbers. Another of these monomers, isoprene, is being manufactured in large quantities from turpentine. All of these elastic polymers to some extent serve uses for which natural rubber was formerly required and it seems likely that even after the emergency these new polymers are going to make a place for themselves in our industry."

Few Plants Suitable

The difficulties that confront scientists in finding sources for natural rubber in latex-bearing plants was discussed in this paper. There are thousands of native plants which produce rubber each year in this country, but very few of these are suitable as sources of rubber even in this emergency, it was said. On this point the paper stated:

"It is significant that Nature with all her varieties of rubber-producing plants gives us predominantly one type of rubber, a polymer of isoprene well known to the rubber industry for its valuable properties. Nature follows an inscrutable pattern. The plant cells which give rubber are closely associated with other cells which generally give larger amounts of materials such as resins, nitrogenous bodies and water soluble ingredients which unavoidably contaminate the rubber. In the case of most plants, the percentage of the contaminating materials far exceeds that of rubber. By methods of chemical analysis it is possible to get a first approximation of the ratio of contaminants to rubber hydrocarbon by following certain analytical procedures.

"To simplify the statement of these procedures, the water soluble, and the acetone soluble portions represent contaminants, whereas the benzol soluble portion of plant material represents rubber hydrocarbons. These methods of chemical analysis serve to exclude the less promising from the more promising plants and to classify the portions of a given plant such as leaves, stems and roots which may be available as sources of rubber. Chemical analyses are valuable mainly in excluding obviously impractical plant sources."

Once it is decided to plant a crop and the various steps of propagation, cultivation, irrigation, harvest and storage are determined, important problems remain to be worked out, it was said, in extracting the crop and processing the latex so that impurities and contamination are avoided and the best grade of rubber supplied from a given plant source.

"There are many elusive factors in the secretion of rubber in the cells of plants", was the conclusion of this portion of the paper, "The mechanism of this synthesis is one of Nature's closely guarded secrets. It seems to be associated to some extent with the formation of carbohydrates and the secretion of resins and to have some relation to photosynthesis throughout the life cycle or growth cycle of the plant. The micro-structure of these living factories which give us rubber has been imperfectly understood. There are many problems of an obscure character which constitute a challenge to the finest scientists in the fields of cytology, plant physiology and genetics. These fundamental problems will have to be solved before we can fully meet the challenge of the selection, growth and processing of rubber from domestic sources."

From "The Role of Synthetic Rubber in the War Effort", by Dr. Otis D. Cole, Firestone Tire & Rubber Co.

Speaking of the future of synthetic rubber, this authority believes that improvements in the technique of producing synthetic rubber will make its competition with natural rubber stiffer, even granting the natural rubber can be produced much more cheaply than its present market price. Also the recent price reduction in synthetic rubbers might indicate, it was brought out, that synthetic rubber will meet natural rubber on a more nearly economic basis in the future. "These facts, coupled with the fact that synthetic rubber can be tailor-made to suit special needs makes it only logical to predict that the synthetic product has an almost unlimited future."

The following brief discussion of the physical properties of synthetic rubbers was given in Dr. Cole's paper.

"At this time it would be well to consider actually what physical properties we might expect if we were to use the various Buna type rubbers and neoprene in representative stocks. First we will consider tensile strength, modulus or stress at 400% elongation, and elongation at break. All the synthetic rubbers, with the exception of neoprene, are much inferior to natural rubber in pure gum stocks. As a matter of fact, it is only after the Buna type synthetic rubbers have been compounded with carbon black that they exhibit tensile properties which remotely resemble those of natural rubber stocks. Even then these properties are definitely inferior to those of natural rubber stocks having similar compounding. Neoprene is different in this respect, for the pure gum stock has higher tensile strength than the stock compounded with channel black.

"It is evident that tensile strength is not the complete criterion for judgment of quality of Buna type synthetic rubbers. If it were, none of the Buna types would have been considered further as a replacement for natural rubber in tires, for example. The tensile properties of the Buna types can be improved by special handling during mixing, but experience has shown that this generally is not worth the extra time, trouble, and expense."

Resistant to Swelling

"The resistance of the Buna N type synthetic rubber to swelling when immersed in oils and hydrocarbon solvents is one of the most unusual and important properties of the class. By proper selection of the type of Buna N, swelling in oils or solvents can be controlled to a very close degree. A rather common phenomenon for stocks compounded from these (Buna N types) synthetic rubbers is first swelling and shrinking in oils. The necessity of the proper choice of compounding ingredients for these synthetics has been demonstrated.

"The property of resilience is one which makes rubber an unusual material. In general, the butadiene copolymers, or Buna types of synthetic rubber, show lower resilience than natural rubber. The values for the pure gum stocks of Buna types approach each other at high temperatures, but do not reach those of the natural rubber pure gum stocks. In typical tread (high channel black) stocks the relative differences are not ironed out to any great extent.

In general, the cold resistance of the oil-resistant synthetic rubbers is poor; the more oil-resistant the rubber, the poorer the cold resistance. The use of plasticizers plays an important part in the attainment of good cold resistance with the Buna N and neoprene types of synthetic rubbers. Data show that the less oil-resistant material (Butaprene NM) is more cold resistant in all cases than the more oil-resistant Butaprene NXM.

"All the Buna types and neoprene show remarkable resistance to decomposition by heat. However, all of them harden and stiffen during storage or service at high temperatures. This and the fact that some of them tend to become brittle at high temperatures are the most serious disadvantages of synthetic rubber which remains to be overcome. It is not unlikely that in the near future this remaining drawback will be removed."

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Preventing Butadiene-Air Explosions

BY ADDITION OF NITROGEN AND CARBON DIOXIDE *

By G. W. Jones**
and R. E. Kennedy***

EXPLOSIVE limits for mixtures of butadiene with air and for mixtures of butadiene-air with nitrogen and carbon dioxide have been determined by the U. S. Bureau of Mines, in view of the increased handling of butadiene largely brought about by manufacture of synthetic rubber. Charts and tables have been developed for use in determining the composition of mixtures with carbon dioxide and nitrogen which will prevent butadiene from becoming inflammable.

The experiments carried out by the bureau were designed to give the widest limits of inflammability, thus permitting the data to be applied in industries where large volumes of butadiene-air mixtures might be encountered. Details of the experiments are given in a paper "Prevention of Butadiene-Air Explosions by Addition of Nitrogen and Carbon Dioxide", No. 3691, by G. W. Jones and R. E. Kennedy, of the explosives division of the bureau's Central Experiment Station at Pittsburgh.

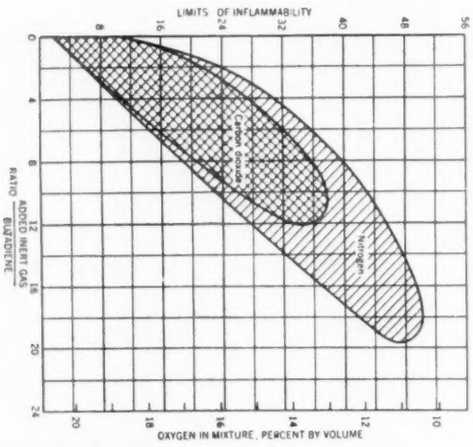

Fig. 1—Inflammability of butadiene-air-nitrogen and butadiene-air-carbon dioxide mixtures

Test Methods

Tests to determine the explosive limits of butadiene in air were carried out in an explosion tube of conventional design. The gases—butadiene and air, and nitrogen and carbon dioxide—were admitted singly to the tube, the composition of the final mixture being determined by the partial pressures of the gases during admission. Ignition of the mixture was by alcohol flame.

Actual determination of the limit of inflammability was by trial and error. The determined value was the average of the mixture-composition that just failed to propagate the flame and the mixture which just propagated the flame through the tube.

The portion of the report which deals with the experimental method and apparatus has been deleted for brevity and the remainder is published below.

° ° °

The limits of inflammability of butadiene in air were first determined and found to be 2.00% for the lower and 11.50% for the upper limit of inflammability. The limits found by the partial-pressure method given in this report agreed with those reported in an earlier publication[1], determined by gas-analysis methods.

Tests were made on butadiene-air mixtures to which various volumes of nitrogen had been added, both in the lower- and upper-limit range. The concentrations of added nitrogen finally became so high that the mixtures became noninflammable when mixed with air in any proportions. The limit mixtures obtained in these tests to establish the entire range of inflammability of butadiene-air-nitrogen mixtures are given in Table 1. The area of inflammability is shown graphically in Fig. 1. The graph shows that at least 19.6 volumes of nitrogen must be added to each volume of butadiene to make all mixtures with air non-inflammable. If less than this amount is added, the mixtures have inflammable limits as shown.

Similar tests were made in which carbon dioxide was added to butadiene, and the limits of the mixtures were determined. Increasing volumes of carbon dioxide were added to the butadiene until mixtures were obtained that were not inflammable when mixed with air in any proportions. The limit mixtures obtained in these tests are given in Table 2 and shown graphically in Fig. 1. As shown by the inflammable area, the extinctive effect of carbon dioxide is greater than that of nitrogen. Whereas 19.6 volumes of nitrogen per volume of butadiene were required to render all mixtures non-inflammable, only 12.1 volumes of carbon dioxide were required under the same conditions.

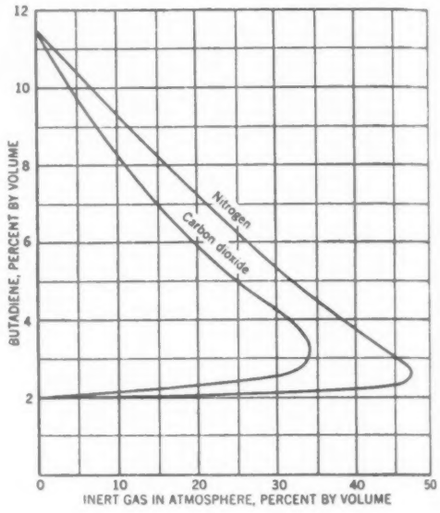

Fig. 2—Limits of inflammability of butadiene in mixtures of air and nitrogen and air and carbon dioxide

The effect of added nitrogen and carbon dioxide on the limits of inflammability of butadiene is shown more clearly by plotting the results as shown in Fig. 2. The percentages

*Portion of Bureau of Mines Report of Investigations 3691, "Prevention of Butadiene-Air Explosions by Addition of Nitrogen and Carbon-Dioxide".

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***Senior scientific aid, Explosives Division, Central Experiment Station, Bureau of Mines, Pittsburgh.

[1]Jones, G. W., and Kennedy, R. E., Limits of Inflammability of Butadiene in Air: Bureau of Mines Rept. of Investigations 3565, 1941.

Table 1—Limit Mixtures of Butadiene, Air, and Added Nitrogen

Composition of limit mixture, per cent by volume			O_2 in mixture, per cent by volume	Added $N_2 + C_4H_6$	Ratio $\frac{\text{Added } N_2}{C_4H_6}$
Added N_2	C_4H_6	Air			
0.00	2.00	98.00	20.51	2.00	0.0
10.00	2.00	88.00	18.42	12.00	5.0
20.00	2.10	77.90	16.30	22.10	9.5
30.00	2.20	67.80	14.19	32.20	13.6
40.00	2.20	57.80	12.10	42.20	18.2
45.00	2.30	52.70	11.03	47.30	19.6
47.50	2.60	49.90	10.44	50.10	18.3
45.00	3.15	51.85	10.85	48.15	14.3
40.00	3.80	56.20	11.76	43.80	10.5
30.00	5.30	64.70	13.54	35.30	5.7
20.00	7.30	72.70	15.22	27.30	2.7
10.00	9.35	80.65	16.88	19.35	1.1
.00	11.50	88.50	18.52	11.50	.0

Table 2—Limit Mixtures of Butadiene, Air, and Carbon Dioxide

Composition of atmosphere, per cent by volume			O_2 in mixture, per cent	Added	Ratio Added CO_2
Added CO_2	C_4H_6	Air	by volume	$CO_2 + C_4H_6$	C_4H_6
0.00	2.00	98.00	20.51	2.00	0.0
5.00	2.05	92.95	19.45	7.05	2.4
10.00	2.15	87.85	18.39	12.15	4.7
15.00	2.25	82.75	17.32	17.25	6.7
20.00	2.35	77.65	16.25	22.35	8.5
25.00	2.40	72.60	15.20	27.40	10.4
30.00	2.50	67.50	14.13	32.50	12.0
34.00	2.88	63.12	13.21	36.88	11.8
34.50	3.23	62.27	13.05	37.73	10.7
32.00	3.95	64.05	13.41	35.95	8.1
27.50	4.60	67.90	14.21	32.10	6.0
20.00	5.85	74.15	15.53	25.85	3.4
13.10	7.50	79.40	16.62	20.60	1.7
6.08	9.68	84.24	17.63	15.76	.6
.00	11.50	88.50	18.52	11.50	.0

of butadiene in the lower- and upper-limit mixtures with increase of nitrogen or carbon dioxide in the mixtures are given. The graphs show that added nitrogen or carbon dioxide, except in rather high concentrations, has very little effect on the lower limit, but the upper limit of butadiene is lowered in almost direct proportion to the amount of inert gases added.

Although the limits of inflammability of mixtures of butadiene and nitrogen and of butadiene and carbon dioxide may be taken from the curves given in Fig. 1, it is easier and more accurate to take the limits from tables prepared for this purpose. Table 3 gives the limits of butadiene-nitrogen and butadiene-carbon dioxide mixtures. The table gives the information required for calculating the limits of inflammability of all mixtures containing added nitrogen and/or carbon dioxide. The actual method of using the tables for calculating the limits has been given in earlier reports [2,3].

Extinction of Flames by Addition of Nitrogen and Carbon Dioxide

The volumes of nitrogen and carbon dioxide required to render 1 volume of butadiene and other combustibles noninflammable, as determined by the Bureau of Mines, are given in Table 4.

The last column showing the relationship between the volumes of nitrogen and carbon dioxide required to produce noninflammable mixtures, is of special interest. All these ratios are close to the average value (0.57) for the various hydrocarbons tested.

The reason for this close relationship appears to be the relative heat capacity of nitrogen and carbon dioxide. If it is assumed that the flame-propagating temperature for the different combustible gases listed is 1,400 deg. C., the mean molar heat capacity between laboratory temperature and 1,400 deg. C. is by calculation, 7.46 for nitrogen and 11.85 for carbon dioxide. If the extinctive effect of the added inert gas is due entirely to the heat-absorbing capacity of the added inert gas, then the relative efficiency of the two gases for extinguishing flames should be proportional to their heat capacities or, inversely, proportional to the volumes of inert gas required to extinguish 1 volume of the different hydrocarbons. The ratio of heat capacities is $7.46/11.85 = 0.63$, while the average ratio, as given in Table 4, is 0.57. The results given in Table 4 seem to confirm the conclusion[4] that the effect of nitrogen and carbon dioxide in extinguishing flames is due largely to their heat capacity.

If the volume of nitrogen or carbon dioxide required to extinguish the flames of a given hydrocarbon is known, the volume of the other gas required may be calculated with fair

Table 3—Limits of Inflammability of Butadiene-Nitrogen and Butadiene-Carbon Dioxide Mixtures

Vols. N_2 per vol. C_4H_6	Limits of Inflammability, % by Vol. Lower	Upper	Vols. CO_2 per Vol. C_4H_6	Limits of Inflammability, % by Vol. Lower	Upper
0.0	2.0	11.5	0.0	2.0	11.5
.5	3.0	15.5	.5	3.0	14.5
11.0	4.0	18.5	1.0	4.0	17.0
1.5	5.0	21.0	1.5	5.0	19.5
2.0	6.0	24.0	2.0	6.5	21.5
2.5	7.0	26.0	2.5	7.5	23.5
3.0	8.0	28.0	3.0	8.5	25.0
3.5	9.0	29.5	3.5	9.5	26.0
4.0	10.0	31.0	4.0	11.0	27.5
4.5	11.0	32.0	4.5	12.0	29.0
5.0	12.0	33.5	5.0	13.0	30.0
5.5	13.0	35.0	5.5	14.5	31.0
6.0	14.0	36.0	6.0	15.5	32.0
6.5	15.5	37.0	6.5	17.0	33.0
7.0	16.5	38.0	7.0	18.0	34.0
7.5	17.5	39.0	7.5	19.0	35.0
8.0	19.0	40.0	8.0	20.5	36.0
8.5	20.0	41.0	8.5	22.0	36.5
9.0	21.0	41.5	9.0	23.0	36.8
9.5	22.0	42.5	9.5	24.5	37.0
10.0	23.5	43.0	10.0	26.0	37.5
10.5	24.5	43.5	10.5	27.5	37.7
11.0	25.5	44.0	11.0	29.0	37.5
11.5	27.0	45.0	11.5	31.0	37.0
12.0	28.0	45.5	12.0	33.0	36.0
12.5	29.0	46.0	12.2	Noninflammable.	
13.0	30.0	47.0	...	...	...
13.5	31.5	47.5	...	...	...
14.0	32.5	48.0	...	...	...
14.5	34.0	48.5	...	...	...
15.0	35.0	49.0	...	...	...
15.5	36.0	49.0	...	...	...
16.0	37.0	49.5	...	...	...
16.5	38.5	49.5	...	...	...
17.0	39.5	50.0	...	...	...
17.5	41.0	50.0	...	...	...
18.0	42.0	50.1	...	...	...
18.5	43.0	50.0	...	...	...
19.0	44.5	49.5	...	...	...
19.5	46.0	48.5	...	...	...
19.7	Noninflammable		...	...	...

[2]Jones, G. W., Inflammability of Mixed Gases, Bureau of Mines Technical Paper 450, 1929.

[3]Jones, G. W., and Kennedy, R. E., Inflammability of Mixed Gases; Mixtures of Methane, Ethane, Hydrogen, and Nitrogen, Bureau of Mines Report of Investigations, 3172, 1932.

[4]Coward, H. F., and Jones, G. W., Limits of Inflammability of Gases and Vapors: Bureau of Mines Bull. 279, 1939.

Table 4—Extinction of Flames by Addition of Nitrogen and Carbon Dioxide

Hydrocarbon	Limits of inflammability per cent by volume Lower	Higher	Volumes of inert gases required to render 1 volume of hydrocarbon gas noninflammable under all conditions of dilution with air N_2	CO_2	Ratio $\frac{CO_2}{N_2}$
Methane	5.00	15.0	6.0	3.3	0.55
Ethane	3.22	12.5	12.8	7.3	.57
Propane	2.37	9.5	14.9	7.9	.53
Butane	1.85	8.4	17.2	9.3	.54
Pentane	1.45	7 8	22.3	12.2	.55
Hexane	1.25	6.9	25.0	14.0	.56
Butadiene	2.00	11.5	19.6	12.0	.61
Ethylene	2.75	28.6	15.3	9.0	.59
Propylene	2.40	10.3	14.0	7.7	.55
Cyclopropane	2.45	10.4	13.5	8.0	.59
Hydrogen	4.00	74.2	16.5	10.2	.62
Carbon monoxide	12.50	74.2	4.1	2.2	.54
Average	...	...	...	...	.57

Table 5—Oxygen Values Below which Flames of Combustible Gases and Vapors are Extinguished

Combustible	O_2, % by volume below which no mixture is inflammable (mixtures tested in 6-ft. explosion tube 2 in. in diameter; flame propagated upward) When N_2 is added to combustible-air mixture	When CO_2 is added to combustible-air mixture
Hydrogen	5.0	5.9
Carbon monoxide	5.6	5.9
Methane	12.1	14.6
Ethane	11.0	13.4
Propane	11.4	14.3
Butane	12.1	14.5
Pentane	12.1	14.4
Hexane	11.9	14.5
Ethylene	10.0	11.7
Propylene	11.5	14.1
Cyclopropane	11.7	13.9
Pittsburgh natural gas	12.0	14.4
Methylene dichloride	18.3	...
Butadiene	10.4	13.1

accuracy by using the average ratio given in Table 4.

Oxygen Required to Prevent Explosions

In recent years inert gases have been used to dilute explosive atmospheres and thereby dilute the oxygen concentration to the point where the mixtures become noninflammable. The graphs in Fig. 1 give directly the oxygen percentage required to prevent explosions for each particular concentration of butadiene. The percentage of butadiene plus inert gas (added nitrogen or carbon dioxide) is plotted on the vertical axis, and the ratio of added inert gas to the butadiene present is plotted on the horizontal axis. The oxygen values below which flames cannot propagate are shown by a scale on the right vertical axis. The oxygen values vary with the ratio of inert gas added to butadiene. The mixture of butadiene-air and added nitrogen that will propagate flame with a minimum concentration of oxygen contains 18.3 volumes of added nitrogen per volume of butadiene. This mixture will propagate flame when the oxygen concentration is 10.4% or higher. All other mixtures require higher concentrations of oxygen to propagate flame, as shown.

The minimum oxygen concentration that permits propagation of flame in butadiene-air and added carbon dioxide mixtures is 13.0%; the atmosphere contains 10.7 volumes of carbon dioxide per volume of butadiene.

The minimum oxygen values that permit propagation of flame should be used to determine the extent to which the oxygen must be reduced to prevent explosions for any particular combustible. The respective minimum oxygen values for different hydrocarbons are given in Table 5.

The relationship between the concentration of butadiene and the critical oxygen requirements for the prevention of explosions is shown in Fig. 3. The graphs give the inflammable area of all possible mixtures of butadiene, air, and added nitrogen or carbon dioxide. The straight line *ad* represents the composition of mixtures of butadiene and air. The limits shown on this line are 2.0% for the lower and 11.5% for the upper limit. All mixtures between these limits are inflammable. Addition of nitrogen or carbon dioxide lowers the oxygen concentration and narrows the inflammable range, as shown by the shaded areas. Finally, when the oxygen content is reduced to 10.4 by the addition of nitrogen the lower and upper limits coincide, and all mixtures of butadiene, air, and added nitrogen become noninflammable. This mixture, which will propagate flame with a minimum concentration of oxygen, contains 2.6% of butadiene. Under similar conditions, when carbon dioxide is added to inflammable mixtures of butadiene and air until the oxygen content is reduced to 13.0% all mixtures of butadiene, air, and added carbon dioxide become noninflammable. This mixture, which propagates flame with a minimum concentration of oxygen, contains 3.2% of butadiene.

When the atmosphere contains 6.8% of butadiene the graph shows that the oxygen concentration needs to be reduced to only 14.7 if nitrogen is used as the diluent to prevent propagation of flame. Although this mixture will not propagate flame when the oxygen content is below 14.7%, it will become inflammable if air is added; since addition of air causes the composition of the mixture to fall along the line to the left toward the *a* axis and through a range of mixtures that are inflammable.

If the problem, when using butadiene-air mixtures, is to control the atmosphere so that the composition at all times is outside the inflammable area bounded by *bce* (when added nitrogen is used as the diluent) and *bck* (when carbon dioxide is used), the graph enables one to determine at a glance the explosive hazards involved. Likewise, as indicated by point *i* an atmosphere containing, for example, 12% of oxygen and 10% of butadiene cannot inflame or explode until air is added. However, if it is desired to remove the butadiene without producing an explosive mixture, the atmosphere must be altered to pass around the explosive area. It becomes necessary to alter the composition of the atmosphere until it falls into the area to the left of the line *aef* when added nitrogen is used as the diluent or *akg* when carbon dioxide is used as the diluent. It is not necessary to reduce oxygen content to zero to pass safely from the composition given by point *j* to atmospheres given by any point to the left of *aef* or *akg*. Nitrogen can be added until the oxygen content drops below a value given at the point where *ih* crosses *aef*, or 4.5% and the corresponding butadiene value of 3.8% or less. The composition of the atmosphere now is such that it cannot be rendered explosive no matter how much air is added, because a line drawn from any point in this area to *a* (the path the composition of the atmosphere takes when air is added) will not pass through the inflammable area. The graph thus indicates the explosive conditions of all mixtures of butadiene, air, and added nitrogen and/or carbon dioxide and permits these conditions to be determined by merely knowing the composition of the mixture.

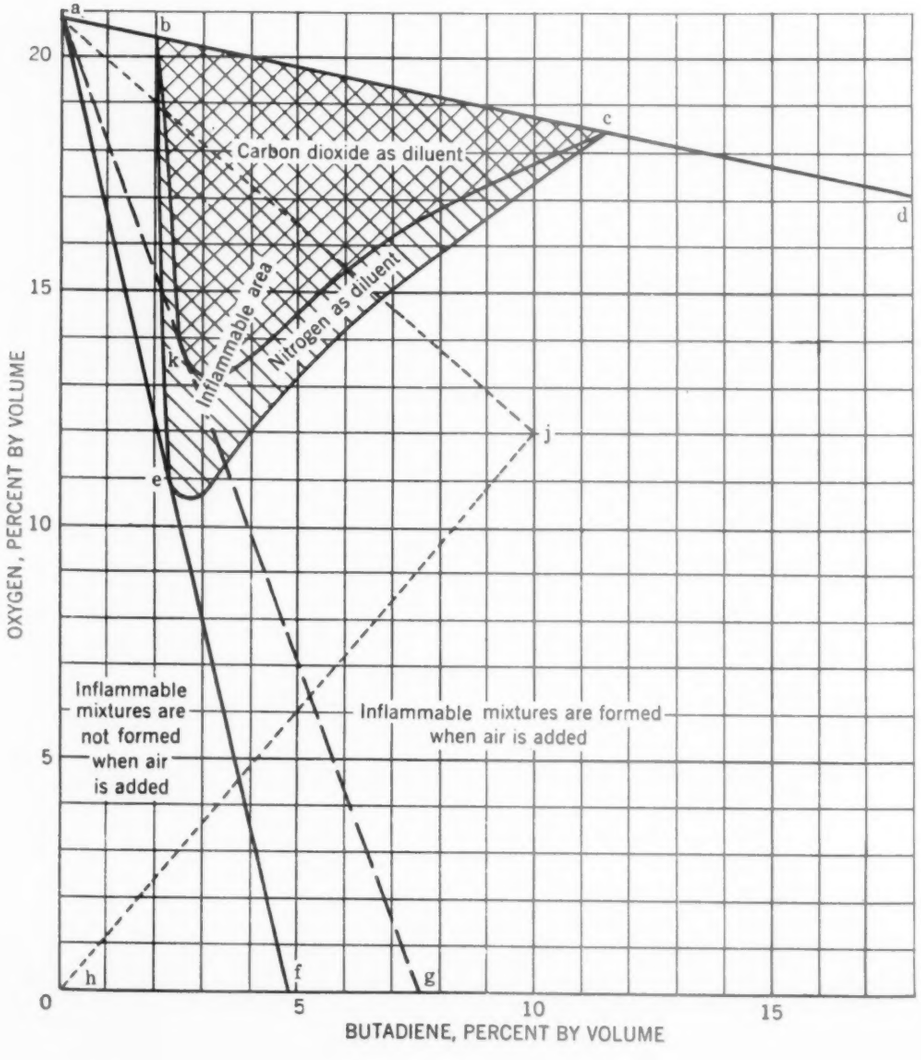


Fig. 3—Inflammability of butadiene, air, and added nitrogen and carbon dioxide

Standards for Pipe Threads Revised

A.P.I. Participates in Revision to Insure Tight Joints in Pipe Used by the Petroleum Industry

STANDARDS for threads for pipe used in the petroleum industry have been enlarged and revised by the American Standards Assn.* to insure tight joints. The American Petroleum Institute, which had previously developed refinements in threads on oil well casing, line pipe and other pipe, through its standards committee, participated in the revision, the data on which has been issued for the use of industry generally.

One important fundamental change from the original 1919 standard for pipe threads (ASA B2-1919) is an increase in the truncation of the crest and root of the external and internal threads (*See Fig.* 1). The original standard had set a blanket minimum truncation of 0.033p, where (p) is the distance in inches from a point on a thread to a corresponding point on the adjacent thread, measured parallel to the axis. This minimum truncation was increased to a maximum of 0.096p for 27 threads per in. and 0.073p for 11½ threads per in. The complete table of maximum and minimum truncations and equivalent widths of flats are given in Table 2 of the new standards (*See table accompanying Fig.* 1).

Tolerances for reference and working plug and ring gages were reviewed and revised in one table in the new standard, their principal use being in the preparation of specifications for gages.

The section of the revised standard covering the specifications for *straight* pipe threads contains the greater part of the new material. "While external and internal taper screw threads are recommended for pipe joints in practically every service", states the standard, "there are certain types of joints where straight pipe threads are used to advantage."

Thread dimensions for 5 of these straight pipe thread joints are covered by the new standard, these being as follows:

Pressure-tight joints for pipe couplings.

Pressure-tight joints for grease cup, fuel and oil fittings.

Free-fitting mechanical joints for fixtures.

Loose-fitting mechanical joints with locknuts.

Loose-fitting mechanical joints for hose couplings.

The limiting dimensions of these types of threads are given in tables in the new standard and while in most cases the data has been published before, this is the first time it has been gathered together in one publication. The new standard also includes a table of "Dimensions for External Taper Pipe Threads for Railing Fittings", which is based on a standard prepared by the Manufacturers Standardization Society of the Valve and Fittings Industry. When applied to both the pipe and the fitting this thread provides a strong mechanical joint with all of the threads of the joint covered, thus taking advantage of both appearance and strength.

A valuable feature of the new standard is the appendix covering "Definition of Symbols Employed in Designating the Dimensions of Taper Thread Elements". This section was prepared by a committee of three representing the National Bureau of Standards, American Petroleum Institute and Sectional Committee B2 of the A.S.A. This list of standard letter symbols, it is believed, will eliminate much of the confusion which has resulted from various institutions and in some cases interested firms using different lists of standard letter symbols for taper pipe thread elements.

The work of revising the pipe thread standards, which is the result of several years' study by organizations and firms directly concerned with the manufacture and use of wrought iron and steel pipe, the manufacture of screwed fittings and the gages for this product, is de-

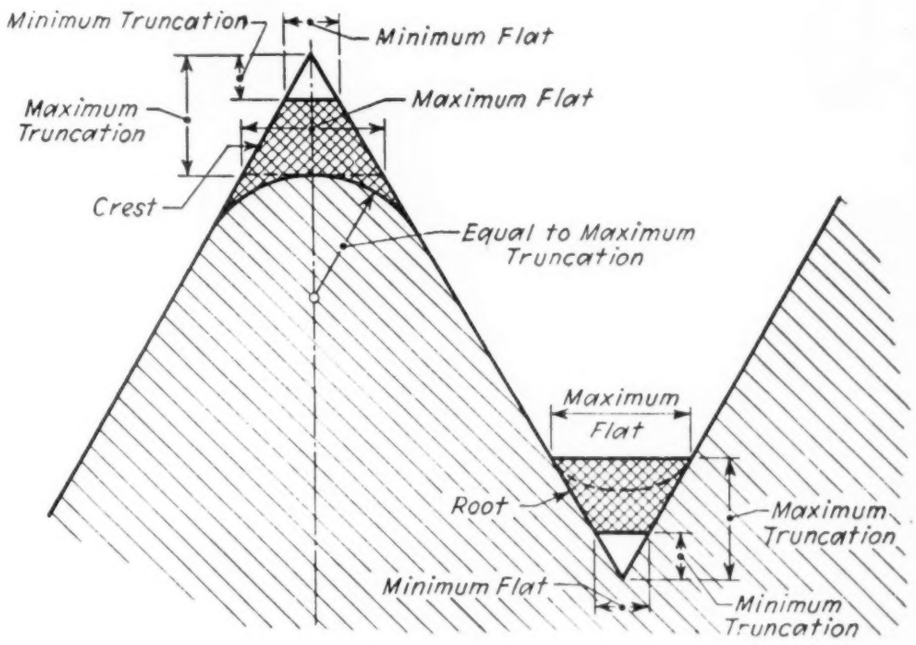


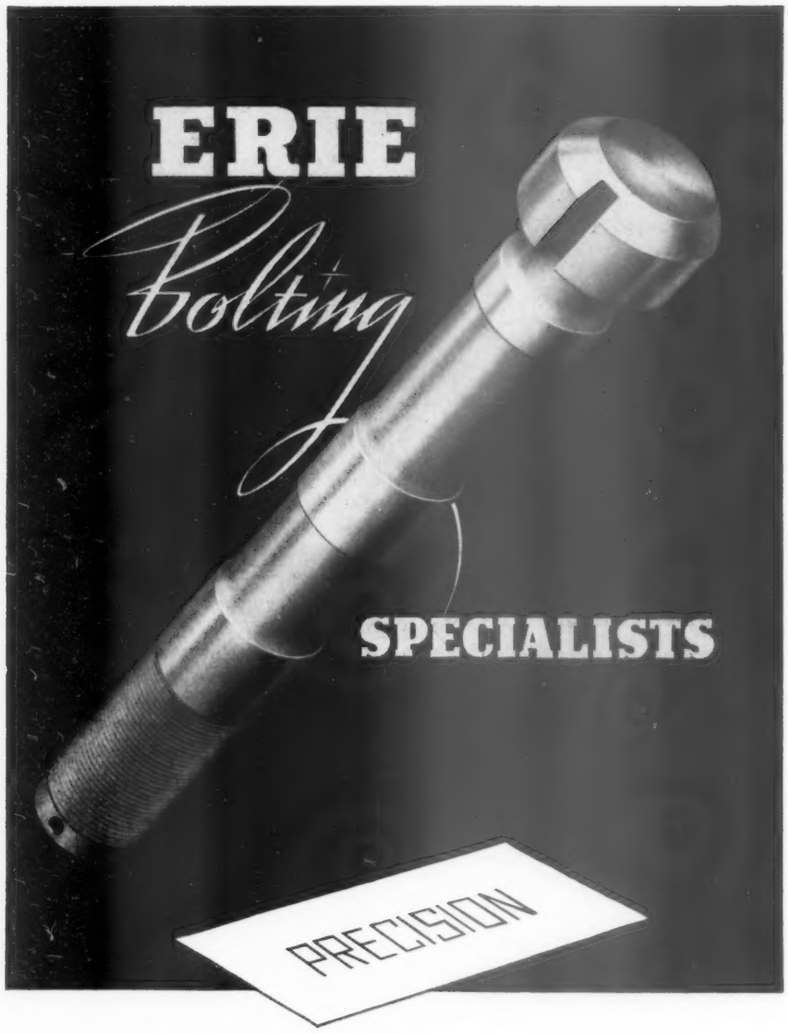
Figure 1

Limits on Crest and Root Truncation on Product

1	2	3	4	5	6	7	8	9
Threads per Inch	Truncation — Minimum — Formula	Truncation — Minimum — Inches	Truncation — Maximum — Formula	Truncation — Maximum — Inches	Equivalent Width of Flat — Minimum — Formula	Equivalent Width of Flat — Minimum — Inches	Equivalent Width of Flat — Maximum — Formula	Equivalent Width of Flat — Maximum — Inches
27 Crest	0.033p	0.0012	0.096p	0.0036	0.038p	0.0014	0.111p	0.0041
27 Root	0.033p	0.0012	0.096p	0.0036	0.038p	0.0014	0.111p	0.0041
18 Crest	0.033p	0.0018	0.088p	0.0049	0.038p	0.0021	0.102p	0.0057
18 Root	0.033p	0.0018	0.088p	0.0049	0.038p	0.0021	0.102p	0.0057
14 Crest	0.033p	0.0024	0.078p	0.0056	0.038p	0.0027	0.090p	0.0064
14 Root	0.033p	0.0024	0.078p	0.0056	0.038p	0.0027	0.090p	0.0064
11½ Crest	0.033p	0.0029	0.073p	0.0064	0.038p	0.0033	0.084p	0.0073
11½ Root	0.033p	0.0029	0.073p	0.0064	0.038p	0.0033	0.084p	0.0073
8 Crest	0.045p	0.0056	0.083p	0.0104	0.052p	0.0065	0.096p	0.0120
8 Root	0.033p	0.0041	0.073p	0.0091	0.038p	0.0048	0.084p	0.0105

Note: Dimensions are specified to four decimal places for convenience.

*American Standard for Pipe Threads (B2.1-1942), approved by American Standards Assn., as developed under sponsorship of American Society of Mechanical Engineers and American Gas Assn., Copies can be secured through 29 W. 39th St., New York, at 75c per copy.



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scribed as follows by the A.S.A.

"The American Gas Assn. and the American Society of Mechanical Engineers originally sponsored this standard in 1918 and they reorganized Sectional Committee B2, which undertook the present revision.

"The original proposal for standard pipe threads in the U. S., which Robert Briggs made prior to 1882, set up the standard taper of 1 in 16 (¾ in. to 1 ft.), the formulas for the major diameter of the thread at the end of the pipe and the tolerance on the length of the thread. The 1919 standard included a transformation of the formulas in terms of the pitch diameter of the taper thread at the end of the pipe, the addition of certain pipe sizes, the addition of tolerances on the dimensions, the tabulation of the dimensions and tolerances in more complete form and the establishment of necessary practical details for the gages and gaging of this type of thread.

"One important contribution which the 1919 standard made was the setting up of a truncation of 0.10p at the crest and root of the plug and ring pipe thread gages. Experience and tests had established the importance of the practice of gaging the flank of the thread, a practice which permits the gaging of threads made with tools after they have become slightly worn; and further, to facilitate the grinding of the flanks of the gages, it permitted the undercutting of the roots. Another important provision set up by this standard was the reduction of the tolerance on the diameter and length of the international and external thread to one turn large and one turn small.

"It will be realized, therefore, that the 1919 standard went a long way toward the practical application of the Briggs theoretical taper pipe thread to the needs of industry. However, many details were left for further study and actual experience with tools and gages and the more modern methods of measurement.

"A stimulus to this process was given by the several standards committees of the American Petroleum Institute. Their work on a standard thread for oil well casings and their development of further refinements in the threads used on the A.P.I. line pipe was a factor in furthering the art of making and gaging taper pipe threads. The satisfactory performance of this product called for the production of better threads than might be expected in the general run of threaded product based only on the 1919 standard. The strength and tightness of the joint are the important considerations.

"During the period immediately preceding the present revision, the federal government services, including the Army and the Navy, also developed specifications for pipe threads and the pipe fitting industry made a detailed study of the threading and gaging of screwed fittings. The principal object of this study was to establish the necessary tolerances and threading practice which would produce tight joints with steel fittings. This called for closer workmanship than that required for other commercial fittings of cast iron, malleable iron and brass."

It was these studies that convinced the members of the A.S.A. committee of the necessity for the important fundamental revision in increasing the truncation limits of the crest and root of external and internal threads.

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Of Refining Technology Articles

January-June, 1943

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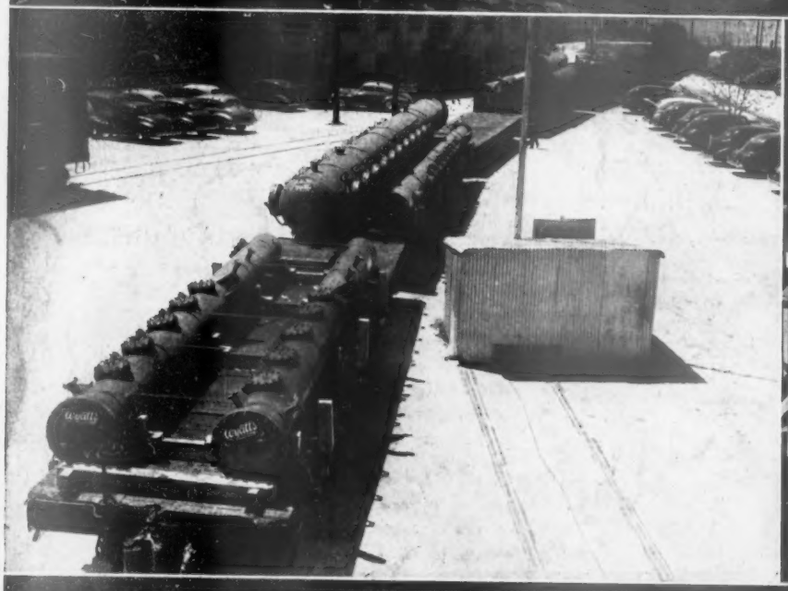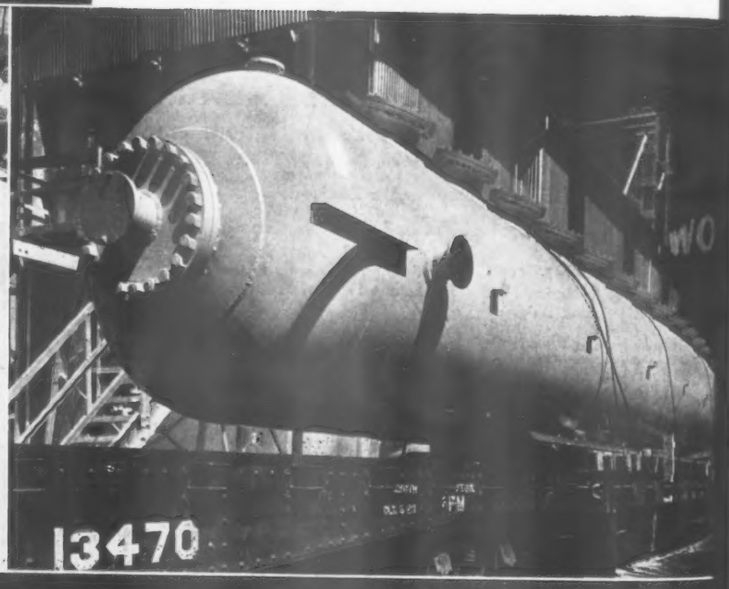
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